OPERATION & CALIBRATION MANUAL

DRM Family of Wireless Data Radiation Monitors

DRM-1, DRM-1D, DRM-2, DRM-2D

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Revision 5
April 2008

MGP INSTRUMENTS
HP Division

Revision Log

Revision #	Date	Revised Pages	Comments
0	July 2004	N/A	Original issue.
1	March 2005	ALL	Added DRM-1D information, specifications, calibration, FCC information about WRM2, instructions on using RMV software (removed AMPView), and section for optional display unit and corrected typographic errors (formatting). Changed title.
2	May 2005	6,11-13, and 30	Added outline drawings for the DRM-1/D and information about the automatic background subtraction feature for the DRM-1D
3	October 2006	15	Added note about dipswitch settings for field use and calibration, section 3.22 Better description of DRM-1D calibration, Section 9.1 Various editing throughout manual
4	July 2007	All	Inclusion of DRM-2/2D, Power Saving Mode update, Environmental & Solar Enclosure configurations, minor editing through-out.
5	April 2008	ALL	Added new features with firmware 071111 for DRM-1 and DRM-2 for 4 threshold settings and selectable using the 'ACK' button on the DRM-1 display or DRM-2. Added new screen shots of RMV for threshold settings and instructions

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WRM-2 FCC COMPLIANCE

WARNING:

This device complies with Part 15 of the FCC rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation, FCC ID Number: '*our9xstream'*.

ANTENNA WARNING

WARNING:

This device has been tested with Reverse Polarity SMA and MMCX connectors with the antennas that are supplied with the equipment. When integrated in the OEM product, these fixed antennas require installation preventing end users from replacing them with non-approved antennas. Any antennas not supplied by MGP Instruments must be tested to comply with FCC Section 15.203 for unique antenna connectors and section 15 emissions.

FCC QUALIFICATIONS

Important: **The WRM2 radio modules have been certified by the FCC for integration into OEM products without any further certifications (as per FCC section 2.1091). Changes not expressly approved by MGP Instruments could void the user's authority to operate this equipment.**

Note: **The WRM2 System utilizes a proprietary communication (WRM) protocol and specific firmware identification for each component and is configured for optimal performance.**

Operation of the WRM2 system in a configuration not consistent with MGPI settings, or modifications to hardware and firmware may result in degraded system performance and loss of warranty.

CAUTION: **Only the power supplies and batteries specified by MGPI should be used with all DRM components. Non-approved power sources can result in component damage or personal injury. Contact MGPI for additional information!**

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1. DRM-1/2 and DRM-1D

1.1. General Description

The Data Radiation Monitor - DRM-1/2, is an auto switching two GM-tube based dose rate meter and the DRM-1D is a sensitive CsI (Tl) scintillated coupled to a PMT. The DRM-1/2 are dose rate meters for detection, using state-of-the-art microprocessor-based technology and combined with telemetry using the WRM2 900 MHz or 2.4 GHZ FHSS radio. The DRM is designed for highly stable and accurate dose rate measurements from gamma radiation. The DRM-1/2 (GM) measuring range is from 0.05 mR/h up to 1000 R/h and the DRM-1D's measuring range is from 0.001 mR/h up to 10 mR/h.

The DRM is a lightweight and compact instrument with sophisticated software offering special features and optimal performance for telemetry data. The wide dynamic range is obtained by the DRM-1's two GM-Tubes with automatic range switching and an automatic dead time correction, according to the preset calibration. The DRM-1D's sensitive range is obtained by CsI(Tl) scintillator (30*30mm) coupled to PMT and an automatic dead time correction and back ground subtraction, according to the preset calibration. A special averaging function smoothes the data reading and maintains fast response time, while keeping the standard deviation at a minimum for both DRM-1/2 and DRM-1/2D

Software is used to configure (RMV) and calibrate (RMC) the DRM family of detectors.

An automatic self-diagnostic procedure continuously checks both electronics and detectors and reports any case of detector failure.

The DRM may be used in the following ways:

- by connecting the meter to a PC
- by connecting the meter to a DDC-16/AM-16 Area Monitor (wired)
- by using the internal WRM2 FHSS radio to transmit data
- by connecting the meter to an external WRM transmitter (wireless)
- by using an internal or externally connected network adapter

The meter includes four boards: HV board, CPU board, WRM2 radio and the board for the dual GM-Tube detectors or a cesium iodine detector. A built-in RS-232 is the connection used for calibration and configuration. A custom connector is needed when using the WRM external transmitter. The WRM2 FHSS radio is already included in the DRM-1/2 package and a base station (MGPI P/N: WR2-9001) is needed for reception of telemetry data. A second DB-9 female connector is available for an optional alarm and display unit for the DRM-1/1D.

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1.2 Applications for GM-Tube (DRM-1, DRM-2) and CsI (DRM-1D) Detectors

- Perimeter & Boundary Surveillance
- Vehicle Access Points
- Turnstile entries
- Collection of Survey Data for Real-time Mapping & Surveillance Software
- General Area Monitoring
- Hospital Emergency Room Entrances and CBRNE storage areas
- Response vehicles
- Event Monitoring

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2. DRM Specifications

2.1 DRM-1 General (GM Tube)

- **Detector**
  - GM tube ZP-1301 (or equivalent) - high range
  - GM tube ZP-1201 (or equivalent) - low range
  - Optional GM tube ZP-1300 non-energy compensated – low range
  - Optional CsI (Tl) detector

- **Measuring Ranges** :
  - 0.05 mR/h to 1000 R/h (0.5 µSv/h to 10 Sv/h)
  - Automatic switching between the two GM tubes at 600mR/h and 800mR/h

- **Accuracy**
  - ±10 % of reading, within the measuring range

- **Energy Response (^{137}Cs)**
  - ±20 % at 70 keV to 2 MeV

- **Sensitivity** (^{137}Cs):
  - 17 cps/mR/h (low range)
  - 0.3 cps/mR/h (high range)

- **Power Source**
  - External power supply and battery backup
  - External power supply: Input 120-250 Vac, Output 6 Vdc to 15 Vdc with locking connector
  - Battery back-up: Three (3) 1.2v NiMH 2100mA rechargeable
  - Battery operating lifetime: Up to 12 hours of continuous operation
  - Power Saving Mode On/Off using Meter View Software

- **Temperature Range**
  - Operation: -10°C to +50°C (15°F to 122°F)
  - Storage: -20°C to + 60°C (-5°F to 140°F)

- **Humidity Range**
  - 10% to 95% RH (non condensing)
  - Enclosure MaterialAluminum

- **Dimensions**
  - Width: 108 mm (4.25”)
  - Length: 178 mm (7”)
  - Height: 64 mm (2.5”)
  - Weight:: 907 gr. (2 lbs)

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- **Optional Accessories**
  - Remote Display Unit (external visual & audible alarm)
  - Magnet attachments

2.2 DRM-1D/2D Cesium Iodine (TL) Specifications

- **Detector:**
  - CsI (Tl) (30 x 30 mm) crystal optically coupled to PMT with 0.5 mm aluminum housing and solid mu metal shield. With optional automatic background subtraction using the RMV software.

- **Measuring Range**
  - 1uR/h to 9999 uR/h (0.001 mR/h to 9.999 mR/h)
  - Overflow Alarm for reading > 9999 uR/h
  - Overload for field > 1 R/h
  - Sensitivity: 6.8 cps/uR/h for 137-Cs
  - Optional : background subtraction via the RMV software

- **Display range**
  - 0.01 mR/h to 10,000 mR/h

- **Dimensions**
  - **DRM-1D**: 7" L x 3.5" D x 4.25" W
  - **DRM-2D**: 10.25" L x 4.28" D x 4.88 W

- **Display – LCD Readout:**
  - 4 digits for accurate and easy display
  - Detector failure
  - Low battery
  - Overflow
  - 4 Threshold Settings

- **Audio:**
  - Two internally mounted piezo-electric elements (used for alarm functions)

- **Accuracy (^{137}Cs)**
  - ±10 % of reading, within the measuring range

- **Energy Response**
  - 45 KeV to 2 MeV

- **CsI Sensitivity** (^{137}Cs):
  - 6.8 cps/µR/h

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- **Power source**
  - External power supply and battery backup
  - External power supply: Input 120-250 Vac, Output 9 to 15 Vdc with locking connector
  - Battery back-up: Three (3) 1.2v NiMH 2100mA rechargeable
  - Battery operating lifetime: Up to **8 hours** of continuous operation (with optional Alarm and Display Unit: **4 hours**)
  - Power Saving Mode On/Off using Meter View Software

- **Temperature Range**
  - Operation: -10°C to +50°C (15°F to 122°F)
  - Storage: -20°C to + 60°C (-5°F to 140°F)

- **Humidity Range**
  - 10% to 95% RH (non condensing)
  - Enclosure Material Aluminum

2.3 DRM-2 Specifications

- **Detector**
  - GM tube ZP-1301 (or equivalent) - high range
  - GM tube ZP-1201 (or equivalent) - low range
  - Optional GM tube ZP-1300 non-energy compensated – low range
  - Optional CsI (Tl) detector

- **Measuring Ranges** :
  - 0.05 mR/h to 1000 R/h (0.5 µSv/h to 10 Sv/h)
  - Automatic switching between the two GM tubes at 600mR/h and 800mR/h

- **Display Range:**
  - 0.01 mrem/hr to 10,000 mrem/hr

- **Accuracy**
  - ±10 % of reading, within the measuring range

- **Energy Response (^{137}Cs)**
  - ±20 % at 70 keV to 2 MeV

- **Sensitivity** (^{137}Cs):
  - 17 cps/mR/h (low range)
  - 0.3 cps/mR/h (high range)

- **Power Source**
  - External power supply and battery backup
  - External power supply: Input 120-250 Vac, Output 6 Vdc to 15 Vdc with locking connector

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- Battery back-up: Three (3) 1.2v NiMH 2100mA rechargeable
- Battery operating lifetime: Up to 12 hours of continuous operation
- Power Saving Mode On/Off using Meter View Software

- **Display – LCD Readout:**
  - 4 digits for accurate and easy display
  - Detector failure
  - Low battery
  - Overflow
  - 4 Threshold Settings

- **Audio:**
  - Two internally mounted piezo-electric elements (used for alarm functions)

- **Measurement Units:**
  - mrem/hr

- **Controls:**
  - Alarm Acknowledgment push-button
  - DIP Switches for functionality

- **Temperature Range**
  - Operation: -10°C to +50°C (15°F to 122°F)
  - Storage: -20°C to + 60°C (-5°F to 140°F)

- **Humidity Range**
  - 10% to 95% RH (non condensing)
  - Enclosure MaterialAluminum

- **Dimensions**
  - 10.25” L x 4.28” D x 4.88 W

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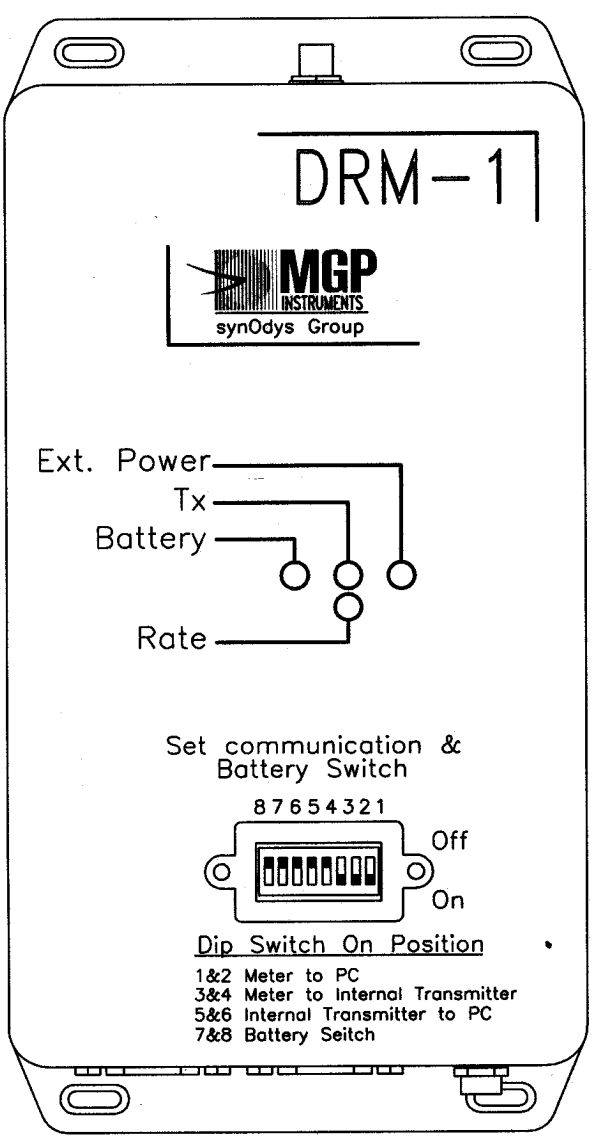
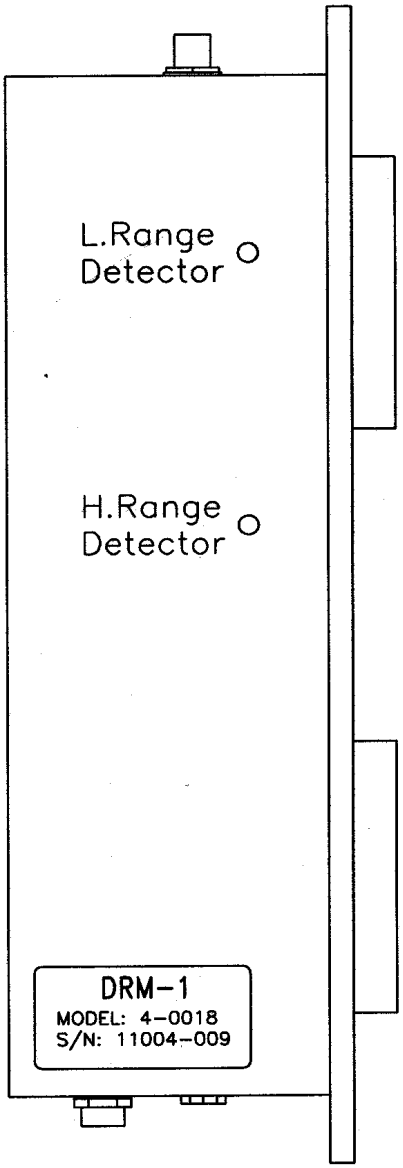
2.4 DRM Outline Drawings



FRONT VIEW



SIDE VIEW

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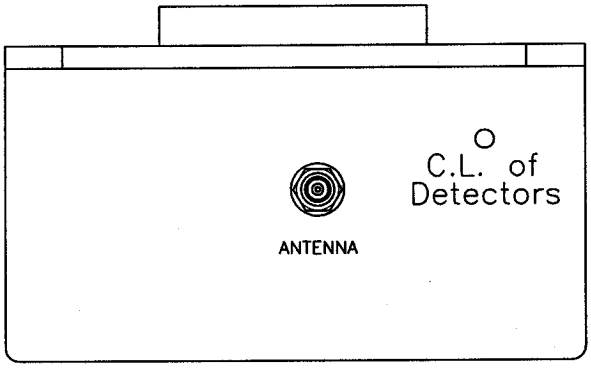
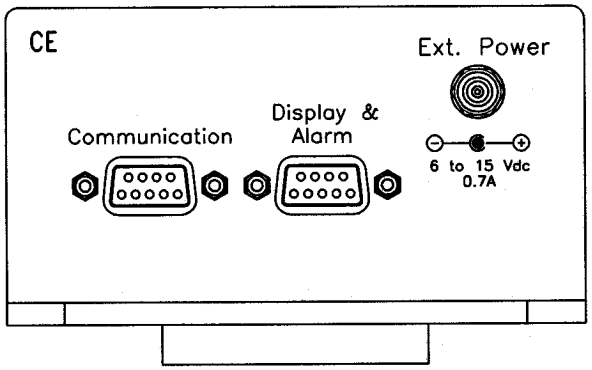
2.4 DRM Outline Drawings (continued)



TOP VIEW



BOTTOM VIEW

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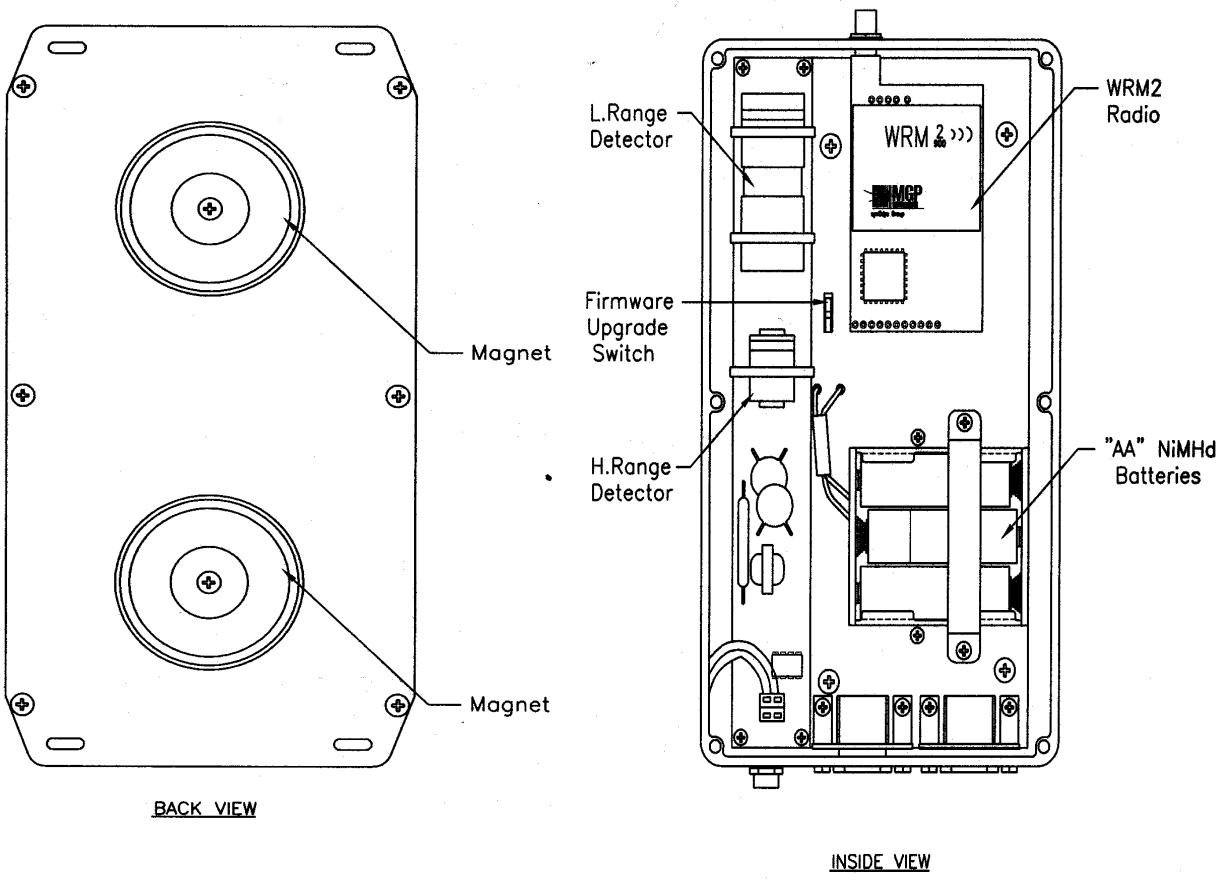
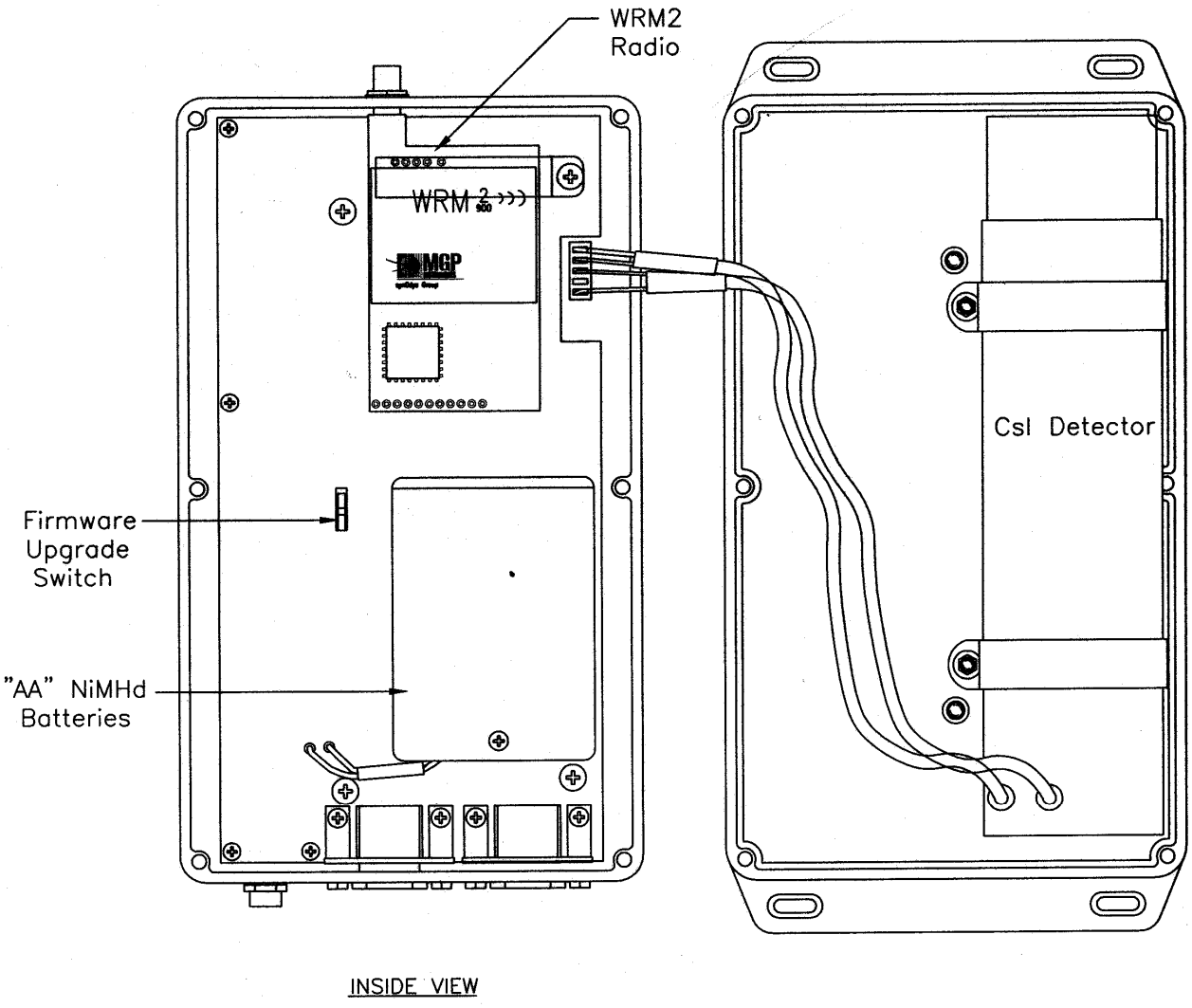
2.4 DRM Outline Drawings (continued)

DRM-1 Inside View



2.5 DRM-1D Outline Drawings

DRM-1D Inside View



2.6 Over the Air Communications

900 MHz or 2.4 GHz FHSS (Frequency Hopping Spread Spectrum) Radios with External Antenna (WRM^2 system) – Base receiver required for use with WRM^2 or WRM91, EXT-2000 External Transmitters and WRM-Plus receiver.

2.7 Response Times for the GM Tubes

Table 1
Response Time for Small Changes

Radiation Field Range [mR/h]	Response Time [sec.]
< 0.5	45
0.5 - 1.5	30
1.5 - 2.5	20
2.5 - 6	10
6 - 12	6
12 - 24	4
20 - 60	3
60 - 800	2
0.6 - 1.2 R/h	5
1.2 - 2 R/h	4
2 - 3 R/h	3
3 - 10 R/h	2 – 3
> 10 R/h	≤ 2

Table 2
Fast Response Time

Radiation field [mR/h] from	to/above	Response Time [sec.]
0.05	1.0	≤ 2
0.5	3.0	≤ 2
1.5	5.0	≤ 2
2.5	12	≤ 2
6	20	≤ 2
12	40	≤ 2
20	60	≤ 2
1 R/h	2 R/h	≤ 2
2 R/h	2.6 R/h	≤ 2

If the radiation field measured by the meter increases significantly, the response time will be ≤ 2 sec. as seen in Table 2. In other cases the response time is according to Table 1.

For example:

- For a radiation field increase from 2.5 mR/h to 12 mR/h, the response time will be ≤ 2 sec.
- For radiation field fluctuations between 2.5 mR/h and 6 mR/h, the response time will be 10 sec.

2.8 DRM-1/2D Response Times for the CsI (TL) Detector

The instrument's response time is less then 2 seconds once the radiation intensity at the reference point increases or decreases by a factor of 10. e.g 0.001 to 0.01 mR/h (1µR/h to 10µR/h).

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3. Operating Instructions

3.1 Preparation for Use

Remove the instrument from the shipping container and check for any physical damage. In the case of damage, report it to the carrier and contact MGP Instruments.

Caution: Do not attempt to install or operate damaged equipment since safety and performance may be affected.

3.2 Starting-up

3.2.1 Connect the antenna to the WRM2 PRSMA connector located on the top of the enclosure. The antenna is only needed when transmitting data over-the- air.

3.2.2 Switch dipswitch 3, for data output from the WRM2 radio, to the ON position or dipswitch 5 & 6 to the ON position when programming the internal WRM2 radio See "Wireless Remote Monitoring Operating Manual", 15-00043 for configuring the WRM2 radio.

Note: Ensure dipswitches 1,2,3,7 and 8 are in the ON position when deploying the unit for field use. Dipswitch 4 must be in the OFF position at on times for field use and calibration.

3.2.3 Switch dipswitch 7&8 to the ON position to engage the battery backup

3.2.4 Connect the external power supply to the locking miniature power supply connector

3.2.5 Connect external WRM transmitter if used and ensure that the baud rate for the DRM and the WRM External Transmitter are set to 300 bps. *The interval level for the DRM needs to be set to ZERO (0), u*sing RMV, so that the WRM transmitter can request the data from the device.

Note: By engaging the battery or the external power supply, the meter will start operating. The unit is not supplied with an On-Off switch.

3.2.6 **NOTE:** (Firmware >= 071111 (MARCH 2008) and board updates) By pressing the 'ACK 'button once on the DRM-1 external display or the DRM-2 will show the current threshold rate setting, **thr.0** then the rate setting i.e., **300**. By pressing the ACK button a second time and so forth will show user preset threshold settings that were **configured using the RMV software**. See section 4.2.10 for RMV software Dose Rate Threshold settings. See section 4.2.10 for more information on setup and usage

ACK → thr.0 = selected ACK→ thr.1 ACK→ thr.2 ACK → thr.3 ACK→ thr.4

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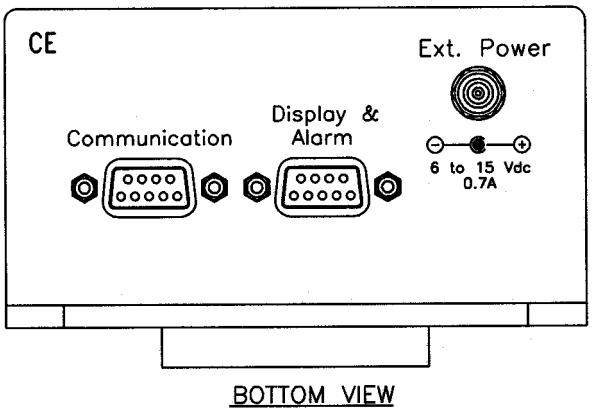
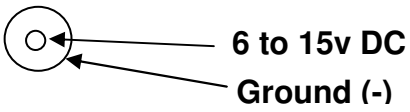
3.3 Meter Connectors



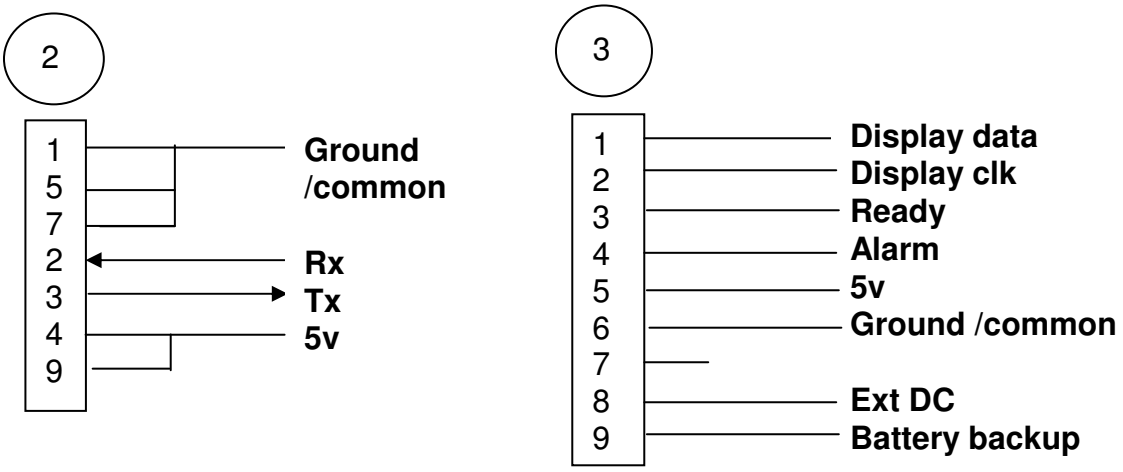
3.3.1 Connectors:

The DRM-1 contains three connectors:

1. 2.5 mm External power supply connector (type L712RA supplied by Switch craft, center post is positive)



2. D-type 9 pin female for RS232 communication port
3. D-type 9 pin male for remote display & alarm



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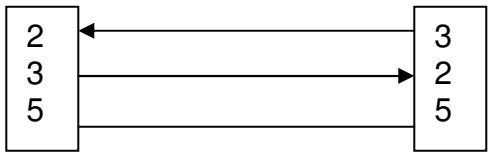
3.3.2 External Connectors:

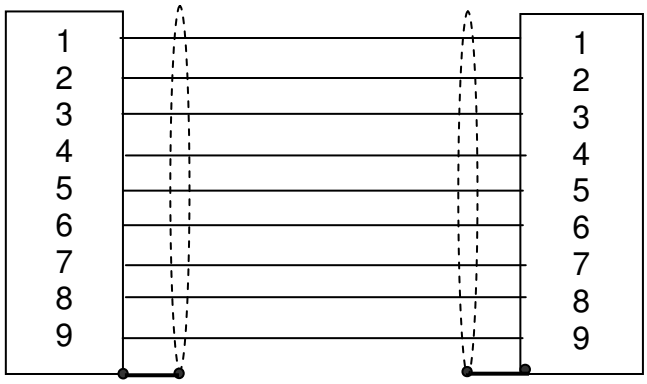
Meter to PC RS232 Cable



D-type 9 pin female **D-type 9 pin male**

Meter to External Display & Alarm Unit (lengh 25')

Display & Alarm Unit **Meter**



D-type 9 pin female **D-type 9 pin female**

3.4 Power Supply & Battery

- External power supply type CINCON 418-TR1507-12 (15v) with locking plug (type 761K Switchcraft - center positive)
- Input 120-250 VAC
- Output 15 VDC 1.6A
- The meter can be operated using DC power from 5 volt to 16volt (0.7A)
- The meter is protected in case of reverse polarity
- Battery backup: 3 units of NiMH GP2100 type AA 1.2V, 2100mA

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4. General Functions

4.1 Dipswitch Selector

To set the dipswitch, unscrew two screws located at the meter front panel and remove the dipswitch cover.

The dipswitch (8 switches) is located on the meter's front panel. Using these dipswitches you can setup two functions:

a) Communication mode, and;
b) Connect-disconnect the backup batteries.

Dipswitches position: For the ON position, press the dipswitch downward.

The DRM has one UART (Universal Asynchrony Receive Transmit Port) and one communication RS232 port; the dipswitch position enables a selection of the communication mode

To set the dipswitch, unscrew two screws located at the meter front panel and remove the dipswitch cover.

4.2 Dipswitch Positions

4.2.1 1&2 On

- Connects the DRM UART to the RS232 communication port via the D-type 9 pin female connector

- Enables connection of the meter to PC for meter parameter setting, calibration or download the meter reading directly to PC, (Using RMV software for configuration and RMC for calibration).

4.2.2 3 On & 4 Off

- Connects the DRM UART to the internal wireless transmitter to send data reading via WRM2. Switch 3 is for transmitting and Switch 4 is for receiving data.

4.2.3 5&6 On

- Connects the internal wireless transmitter to the RS232 communication port via the D-type 9 pin female connector. See "Wireless Remote Monitoring 2 Operating manual, 15-00043" for configuring the WRM2 radio.

- Enables the setting of internal wireless transmitter WRM2 parameters.

4.2.4 7&8 On

- Connects the internal three NiMHd rechargeable batteries for back-up power if the external power is disconnected

Note: If the external power supply is connected, the battery will be charged even though the dip switches 7&8 are in the OFF position.

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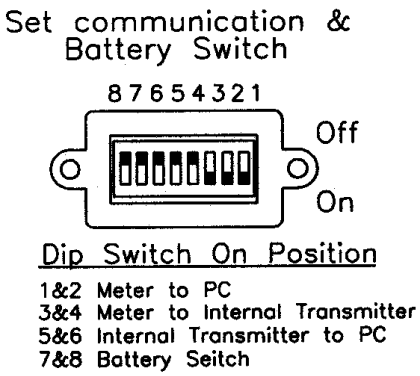
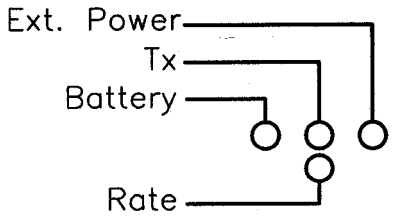
- Set switch 7&8 to the OFF position only in case the meter is being stored.



Important Note:
For operational/configuration settings ensure dipswitches 1, 2, and 3 (dipswitch 3 is for transmitting data) are in the ON position. For field use ensure dip switches1, 2, 3, 7 and 8 are turned ON (7 and8 are for battery backup).

4.2.5 LED position and function

LED	Color	Function
Ext. power	Red	External power supply > 7.5v – led on External power supply < 7.5v – led blinks No external power supply & no Battery – LED off
Tx.	Green	For each transmission sent, the led blinks
Battery	Yellow	Battery connected & Battery voltage > 7.5v – LED is on Battery disconnected or Battery voltage < 7.5v – LED blinks No external power supply & no Battery – LED is off
Rate	Yellow	Blinks according the radiation trend



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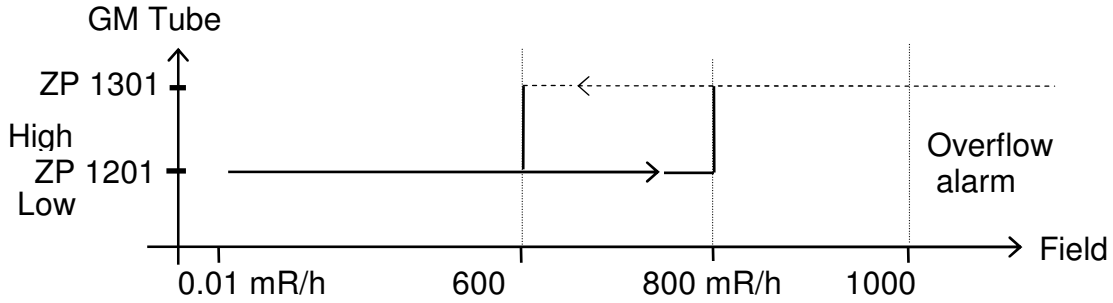
4.2.6 Automatic Range Switching for the DRM-1/2:

The detector includes two GM Tubes:

Low range - ZP-1201 (or equivalent), and high range - ZP-1301 (or equivalent).
In a field of 0.01 mR/h to 800 mR/h both GM tubes are connected and the field is measured by the low range GM tube. If the radiation field is higher than 800 mR/h, the low range detector is disconnected, and the radiation field is measured by the high range GM tube.

The switching between the low and high range GM-Tube is performed at 800 mR/h when the radiation field increases (low range detector is disconnected), and at 600 mR/h when the radiation field decreases (low range detector is connected).



4.2.7 Measuring Range for the DRM-1/2D

- mR/h to 10 mR/h (0.01 µSv/h to 100 µSv/h)
- Automatic background subtraction is available via RMV software
- Overflow Alarm for reading > 10 mR/h
- Overload for field > 1 R/h

4.2.8 Automatic Background Subtraction

For the **DRM-1/2D**, the Automatic Background Subtraction is set (using the RMV software) by changing the 'Background' number to **'9999'.** The DRM-1/2D will count the background for 60 seconds and then set the current background internally. To ensure a new update for the backgrounds, turn off dipswitches 7 and 8 and unplug the AC adapter from power. When the device is powered on, the background will automatically update in 60 seconds. The displayed value on the optional display or software will show the net dose rate.

4.2.9 Power Saving Mode Feature

The Power Saving Mode will reduce power consumption in case the AC power is not present. The WRM2 radio must be setup for **Pin Sleep** configuration, for this function to work properly. Contact MGP Instruments for assistance.

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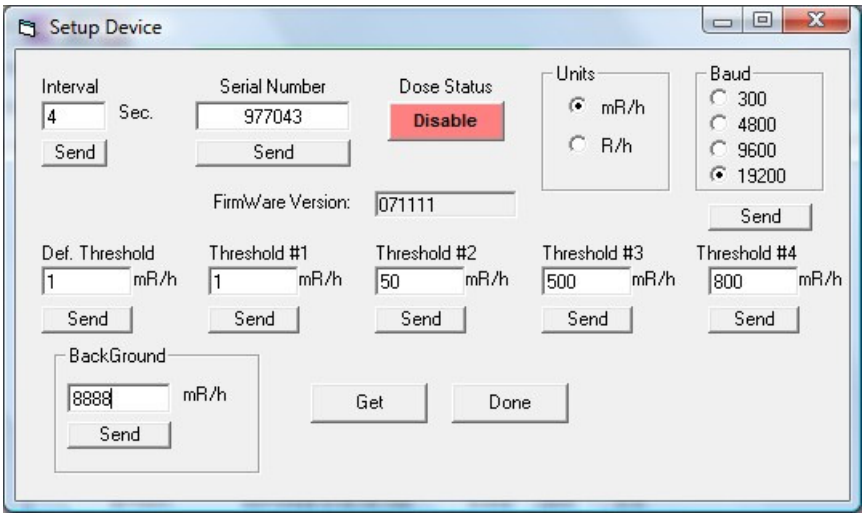
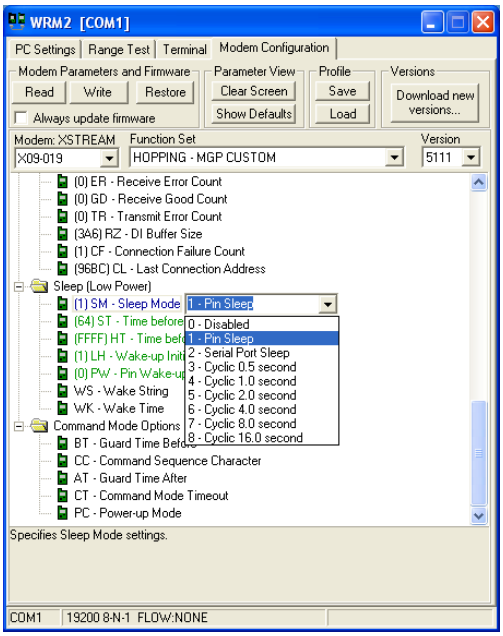
The 'Power Saving Mode' will be activated after the send code '8888' (via RMV in the Background icon) is entered, sent and updated. If the DRM is set for a longer transmission interval (i.e. 60 seconds to conserve power), and the Threshold alarm is reached, the DRM will be set to a transmission interval level of 4 seconds (factory default) and transmit at the interval level until the Threshold Level rate falls below the current set point and the transmission interval level will revert back to 60 seconds.



Example of the Setup Device Window for the DRM in the RMV Software

Note: The sleep mode can be cancelled by the send code '7777' (via RMV in background icon) is entered, sent and updated.



Example of the WRM2 Radio Configuration Screen (pin sleep)

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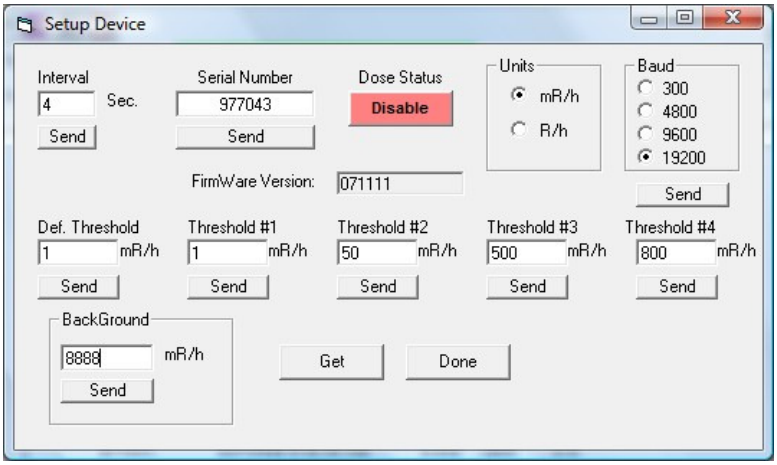
The Interval time level is based on how long a unit can run without AC power, 99 seconds is the maximum transmission time interval.

To check if the DRM is in Power Saving Mode press on the 'GET BUTTON' in the "Setup Device" window in the RMV software and the background window will be display '8888' to signify that the DRM is in the Power Saving Mode.

4.2.10 Dose Rate Alarm Threshold Settings

Dose threshold settings are configured via the RMV software (Version 4.01 and DRM firmware). The Def. Threshold (thr.0) is the current default setting in the DRM, i.e. Threshold (1) one is the current default dose rate threshold (see figure below), thr.0. To change the threshold setting using the ACK button on the display, toggle to the desired Threshold number, i.e. thr.3, let go of the ACK button and the display will show the stored threshold setting and will be defaulted to this rate threshold alarm setting.



Example of the Setup Device Window for with the Dose Rate Threshold Settings

4.2.11 Dose Function

Dose reading can be read as a part of the data record sent by the DRM.
To enable this function:

1) Connect the DRM to the PC and run RMV software
2) Move dipswitch 1&2 to the ON position, and set DOSE enable in the RMV software

If the DOSE reading is disabled, in place of a real dose reading, the record will be shown as **888888.8**. The Dose reading will be reset to zero in two cases: Disable\Enable Dose function, turn the DRM On. Each time the instrument is turned ON; the Dose reading is reset to zero.

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4.2.12 WRM91 or WRM EXT 2000 Transmitter (optional)

WRM91 external radio transmitter can be connected to the DRM following these instructions:

1) Connect the DRM to the PC and run RMV software.
2) Set time interval to "0", and set baud rate to **300**.
3) Connect the WRM adapter to the DRM's Communication connector.
4) Connect the WRM91's RJ-22 connector to the WRM Adapter
5) The DRM will transmit the data to the WRM91/Plus receiver.

Note: The WRM EXT 2000 external transmitter can be connected to the DRM in the same manner as above, however, ensure that the Baud Rate is set to 300. Refer to the EXT-000 Operating Manual, 15-00037, for configuration of the Baud Rate setting.

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4.3 DRM-2 and Optional External Display & Alarm

An optional external display (part # RTM-9135) is available for remote locations of the read-out, audiable and/or visual alarms with and with an alarm acknowledge button.

A 25 foot cable connects the display to the DRM via a D-type 9 pin connector and supplies the power to the remote display. The DB-9 connectors must be fasten securely for the display to operate properly.

Note: Internal battery life is reduced when no external power supplied is used while using the remote display.

Remote Display Functionality Description

Status	Failure	No alarm & ready	Failure	Over threshold alarm
Red Lamp	BLINK	OFF	BLINK	ON
Green Lamp	OFF	ON	OFF	ON
Buzzer	BLINK	OFF	BLINK	ON
Display	FAiL	Dose rate reading [mR/h]	FAiL	Thr and Dose rate reading [mR/h] simultaneous

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4.3.1 DRM-2 and Optional External Display and Alarm Unit

A 7 segment 4 digit display unit displaying in the following formats:

Meter display format:
Measuring reading **0.000 to 9.999** mR/h for the **DRM-1D**
Measuring reading for the **DRM-1**:

1. 0.001 to 9.99
2. 10.0 to 99.9
3. 100 to 999
4. 1.0E to 9.99E
5. 10.0E to 99.9E
6. 100E to 999E

For numbers 1 -3 the units will be mR/h
For numbers 4 -6 (with E) the units will be R/h

OFLO in case of overload, reading > 10mR/h
ALr. and measuring reading blink simultaneity in case of meter reading is over the setting threshold alarm
Err1 in case of detector not connected.
Err2 In case of detector malfunction.

4.4 Battery Replacement

The battery holder is located inside of the DRM meter.

1) Disconnect the external power supply and switch dipswitch 7 & 8 to the OFF position
2) Unscrew the six screws located at the back meter panel.
3) Unscrew the two screws located at omega clip on the battery pack
4) Replace a new set of three 1.2v NiMH 2100 batteries

DO NOT USE ALKALINE BATTERIES AS REPLACEMENTS FOR THE NIMH BATTERIES

5) Screw back on the omega clip on the battery pack
6) Screw back the six screws located at the back meter panel.
7) Connect an external power supply.
8) The battery backup will be charged and ready for use after 16 hours

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5. Communication

5.1 Communication

The communication between the DRM and PC can be performed in 3 ways:

1) Wireless Radio WRM2 located inside the meter.
2) Direct RS232 via the meter communication port (D-type 9 pin female connector using a Null Modem Adaptor).
3) WRM External Transmitter can be connected to the D-type 9 pin female connector via the AMP to WRM adapter.

5.2 Protocol

Communication parameters:

- Baud rate: can be selected between 300, 4800, 9600 and **19200 is the default.**
- Parity: None
- Hardware handshaking: None
- Software handshaking: None
- Stop bit: 1
- Prefix: LF
- Suffix: CR
- Data format: 8 data bits

6. Communication Protocol

Description: DRM data to PC via radio or RS232

Byte 1 LF
Byte 2 to **byte 7** Id meter number for communication set via Meter View software
Byte 8 status = 0x30=okay, 0x31=over load, 0x32=over threshold, 0x33=no external power, 0x34=low backup battery, 0x38=detector fault.
Byte 9 Status = multiple status messages – See information below.
Byte 10 to **byte 16** Dose Reading (x.xxxxx) or 8.88888 in case the Dose is disabled
Byte 17 = 0x30
Byte 18 to **byte 22** rate reading X.YZW * 10^{T}
Byte 23 = 0x30
Byte 24 to **byte 25** check sum
Byte 26 CR

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Byte	Description
1	LF
2	N5
3	N4
4	N3
5	N2
6	N1
7	N0
8	Status
9	Status
10	D5
11	D4
12	D3
13	D2
14	D1
15	D0
16	D-1
17	30H
18	X
19	Y
20	Z
21	T
22	W
23	Status 3 lsb
24	CS msb
25	CS lsb
26	CR

See Table below for Status 9

Status Message - Byte 9

Overflow	Threshold Alarm	Loss of external power	Low Battery or battery OFF	Error with Detector	Status Code
					30H
1					31H
	1				32H
		1			33H
			1		34H
				1	35H
1		1			36H
1			1		37H
1		1	1		38H
	1	1			39H
	1		1		41H
	1	1	1		42H
		1	1		43H
		1		1	44H
		1	1	1	45H
			1	1	46H

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6.1 Set Meter Parameter via the PC

The parameters are set via the PC using the RMV software.

PC to meter

0	1	2	3	4	5	6	7	8	9	10
LF	Status	D5	D4	D3	D2	D1	D0	0F	0F	CR

Status byte:
Read meter parameters=30H
Set Baud=31H
Set Time=34H
Set Threshold alarm value.=35H
Set Dose status = 37H
Set meter serial no. = 38H

6.1.1 Read the Meter Parameters=30H

PC to meter

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
LF	30	20	20	20	20	20	20	0F	0F	CR

Meter to PC

0	**1**	**2**	**3**	**4-9**	**10-14**	**15**	**16-19**	**20**	**21-26**
LF	30	Meter type	Meter unit	Meter #	Thr. value	Meter baud	Down load time	Dose En/Dis	Firmware version

27-28	**29**
36h,37h	CR

Byte 2:
AMP50 = 30
AMP100=31
AMP200=32

Byte 3:
mR/h = 30
uSv/h = 31

byte 15:
300=30
4800=31
9600=32
19200=33

byte 20
disable =30
enable=31

byte 10-14 : threshold X.YZW * 10 T (X=byte10, Y=11, Z=12, W=13, T=14)

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6.1.2 Set down load interval Time=34H

PC to meter

0	1	2	3	4	5	6	7	8	9	10
LF	34	Sec* 1000	Sec*100	Sec* 10	sec	20	20	0F	0F	CR

The interval time can be set from between 0 and 99

6.1.3 Set Threshold alarm value=35H

PC to meter

0	1	2	3	4	5	6	6	7	8	9
LF	35	X	Y	Z	W	T	20	0F	0F	CR

6.1.4 Set Dose status = 37H

PC to meter

0	1	2	3	4	5	6	7	8	9	10
LF	37	D-30 E-31	2 0	20	20	20	20	0F	0F	CR

6.1.5 Set meter serial no. = 38H

PC to meter

0	1	2	3	4	5	6	7	8	9	10
LF	38	D5	D4	D3	D2	D1	D0	0F	0F	CR

6.1.6 Set Baud Rate = 31H

PC to meter

0	1	2	3	4	5	6	7	8	9	10
LF	31	code	2 0	20	20	20	20	0F	0F	CR

↓

Code:
30h=300 32h=9600
31h=4800 33h=19,200

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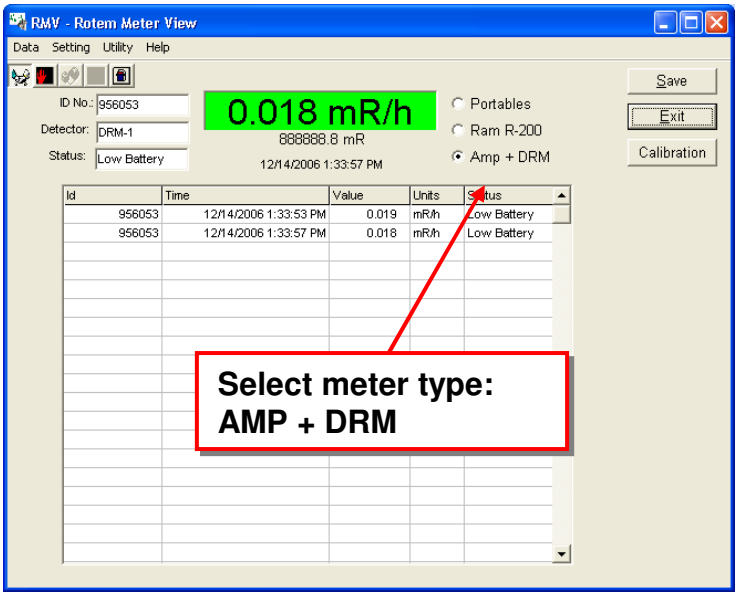
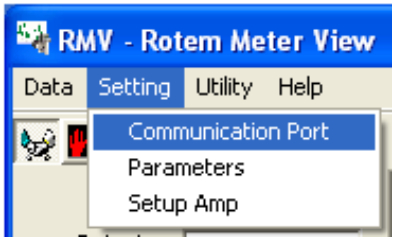
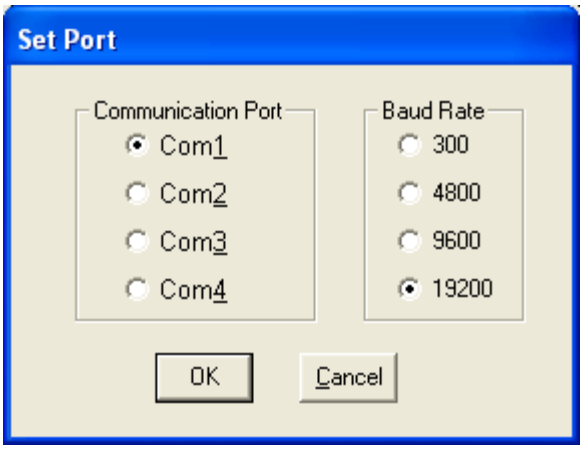
7. Setting Meter Parameters using the RMV Software





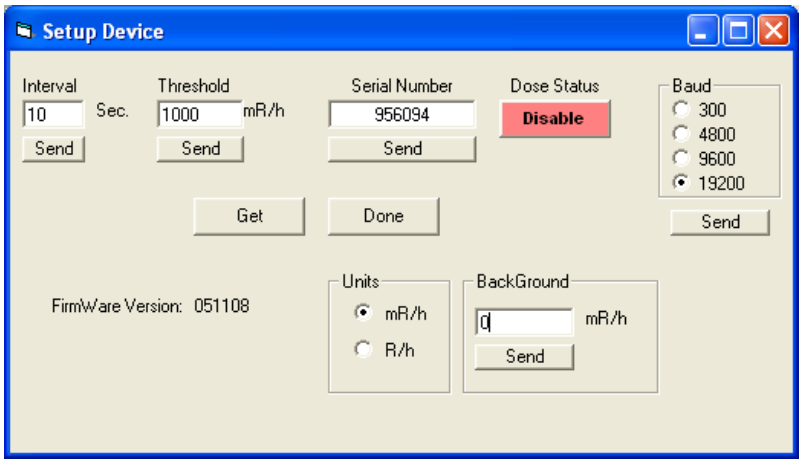
Set PC communication parameters



Set & Display Meter Parameters

To set new parameter value, type the required value on each window and then click on the **Send** button for each parameter.

i.e.: Interval = 10 → Send
Threshold = 1000 → Send



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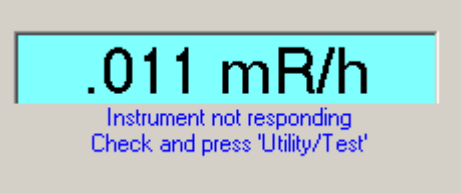
RMV Operating Instructions:

1) Start the RMV software by CLICKING on the CALIBRATION button on the RMV software connect the DRM to the P.C. via the RS232 connection with a null modem connector, ensure dipswitches 1 and 2 on in the ON position.

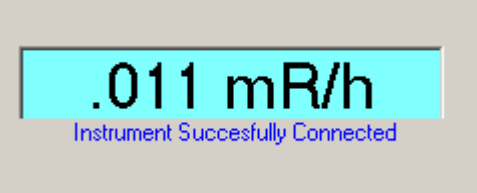
2) Set the correct Communication port

3) Select meter type, **AMP+DRM**

4) Verify that the communication between the meter and the PC is okay. If the communication is fail, change the baud rate by clicking on the **Setting**, **Communication port** button, and select another baud rate. Then click on **Utility**, **Test** to check again.



Failed communication



Communication OK

5) Once the communication is okay, use the **Setting, Setup AMP** button to configure the meter's working parameters.

6) The Serial Number shown in the Setup Device screen refers to the ID number used in the communication protocol and not the serial number of the instrument which is setup using the RMC (Rotem Meter Calibration) or the AMP View software. All portable instruments telemetry ID will start with a '9' followed by the unique identification number

Meter Code for Telemetry (Area Monitors/Portable Instruments 9xxxxx)

Instrument	Type Code
TelePole	0
Ram Ion	1
AMP-50	2
AMP-100	3
AMP-200	4
DRM-1	5
DRM-1D	6

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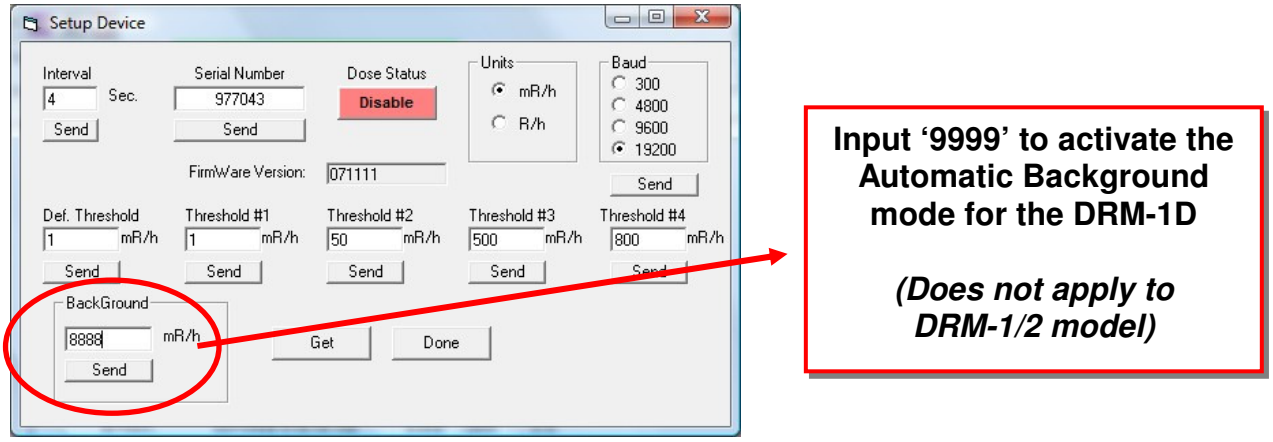
Note: Correlation between the factory serial number and the Telemetry ID #

	Factory S.N.			ID #	
AMP- 50	09	02	801	22	801
AMP-100	50	02	001	32	001
AMP-200	77	02	501	42	501
DRM-1	**11004 - 0008**			**54**	**008**

Example: 9 54 008

Meter type year serial # (DRM-1)



Note: For the DRM-1D/2D, the Automatic Background Subtraction is activated by changing the 'Background' number to '9999' and press Send. The DRM-1/2D will count the background for 60 seconds and then set the current background internally. The displayed value on the optional display or software will show the net dose rate.

Automatic Background Options:

1. When the Backup battery is disconnected (dipswitch 7& 8 in off) , connect the external power supply, the meter will turn ON and enter to calculate the background during the 60 second count, automatically, after 60 second this value will be kept in memory

2. Connect the meter to PC and run the RMV software, in the AMP setup function type '9999' for automatic calculation, the meter will enter to calculate the background during 60 second, after 60 second this value will be kept in memory.

Note: If the threshold alarm setting is lower then the background when performing the automatic background subtraction the alarm will be activated until the background

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is stored and the display is showing the net rate.

3. Connect the meter to PC (using the null modem adapter) and run the RMV software, in the Amp setup function type desirable '9999' the background value.

8. Calibration Summary for the DRM-1/2

8.1 Preface

8.1.1 Calibration Factors

To improve the linearity, the **DRM-1** includes five calibration factors: The two lower factors are for the low range GM tube, from 0.01 mR/h to 800 mR/h; and the other three are for the high range GM tube, from 600 mR/h to 1000 R/h. Once the F factors have been set a linearity verification should be performed on all ranges.

The calibration factors will be set using the RMC software:
F1 - first calibration factor for low range.
F2 - second calibration factor for low range.
F3 - first calibration factor for high range.
F4 - second calibration factor for high range.
F5 - third calibration factor for high range.

- **F1** and **F3** are used to compensate the GM tube sensitivity tolerances.
- **F1** for the low range (ZP1201) and **F3** for the high range (ZP1301).
- **F2, F4** and **F5** are used to compensate the dead time tolerances.
- **F2** for the low range (ZP1201) and **F4**, **F5** for the high range (ZP1301).

8.1.2 Calibration Ranges

F1 must be set at 50 mR/h ± 20 mR/h
F2 must be set at 350 mR/h ± 50 mR/h
F3 must be set at 10 R/h ± 2 R/h
F4 must be set at 200 R/h ± 60 R/h
F5 must be set at 600 R/h ± 100 R/h

Measured (displayed) readings are calculated by one of the following two formulas, depending on the intensity of the radiation field:

- Low range**:** N(mR/h) = [n*F1 + dead time correction {n*F2}]/17
- **High range, up to 300 R/h:** N(R/h) = [n*F3 + dead time correction {n*F4}]/300
- **High range, over 400 R/h:** N(R/h) = [n*F3 + dead time correction {n*F5}]/300

Where
n is the detector frequency obtained in the radiation field.
N is the updated measurement reading.
Between 300 R/h to 400 R/h, a weighed average of F2 and F3 is used as the dead time correction factor. The calculation of the "averaged factor" and the corresponding measurement formula follow:
x = (last N(R/h) - 300)/100

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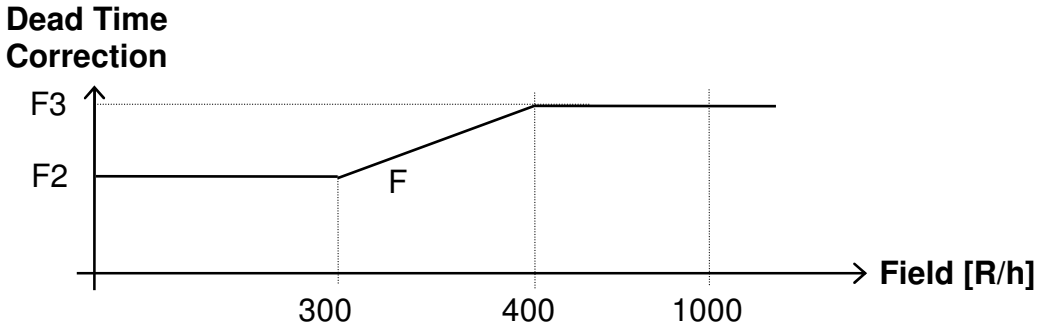
Last N = previous measurement reading
F average = (1-x)* F4 + x* F5
N(R/h) = [n*F1 + dead time correction {n*F average}/300
The following graph illustrates the ranges over which F2, F3 and F average are used as the DRM-1's dead time correction factor:



9. Calibration Summary for the DRM-1D/2D

9.1 Preface

9.1.1 Calibration Factors

The **DRM-1D/2D** requires only one calibration point which requires only one change to **Factor 1 (F1)** in the Meter Calibration software. Once the F1 factor has been set performed, linearity verification should be performed.

The DRM-1D/2D can be calibrated via the RS232 communication port with a NULL modem adapter.

Switch to the ON position dipswitches 1&2 for RS232 and the calibration will be performed by using the Meter Calibration software. Refer to section 10.1 for instructional use of the calibration software

9.1.2 Calibration Ranges

F1 is recommended to be set at 0.1 to 0.2 mR/h.

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10. Calibration Procedure for the DRM-1/2D

10.1 Preface

The DRM-1/2 and the DRM-1D can be calibrated via the RS232 communication port with a NULL modem adapter.

Switch to the ON position dipswitches 1&2 for RS232 and the calibration will be performed by using the Meter Calibration software.

If the radiation field is greater than 10 mR/h, the software will automatically enable the setting of the appropriate factor, depending on the field intensity for the **DRM-1/2**. Refer to section 10.1 for instructional use of the calibration software.

10.1.1 Calibration Ranges

F1 in a field > 10 mR/h and < 100 mR/h.
F2 in a field > 100 mR/h and < 800 mR/h.
F3 in a field > 800 mR/h and < 50 R/h.
F4 a field > 50 R/h and < 350 R/h.
F5 in a field > 350 R/h

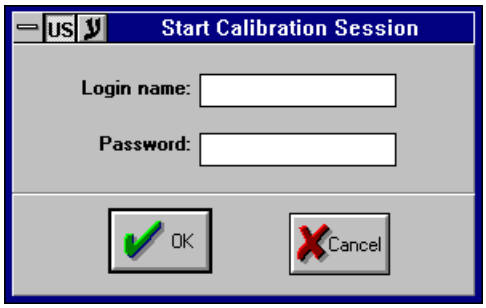
Note: If the radiation field is lower than 10 mR/h, each factor can be set manually by the calibration software.

10.2 Operating Instructions

1. Run the calibration program via the **RMC.EXE** file (or icon).

2. Enter a Login name/calibrator (‘**jsmith**’) name that will appear in the calibration documentation (up to 12 characters).

3. Enter Password – “**mgpi**” in lower case.



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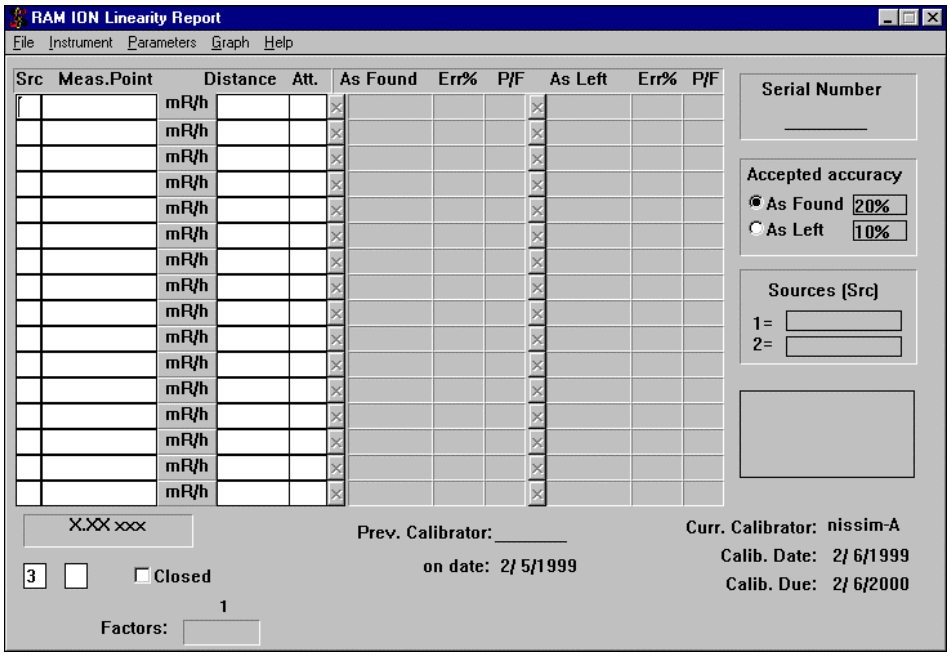
4. Click OK, the program enters the main window.

5. The caption in the main window (linearity report) displays the previous template. In the displayed template the operator executes the required operations to complete the calibration and linearity.

6. To start the procedure, click **File/New Report**.



10.3 Template & Parameters Setup

The template includes setup parameters and instrument parameters. To select or create a new template, proceed as follows.

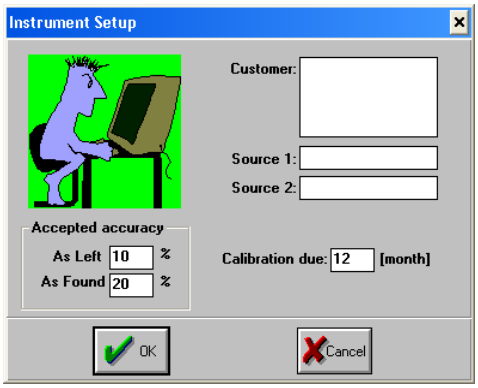
To select an existing template

The RMC program is supplied with a number of default templates. Click File/ Open template and select the required template.

To create a new template

a) Fill the following parameters in the displayed template: Src (source), Measuring Point including units, Distance, and Attenuators. To select between mR/h and R/h, or cps and Kcps, or cpm and Kcpm, click each of the unit's columns.

b) Select **Parameters / Setup** from the pull down menu. Complete the following
Customer - Enter header (up to 4 lines) for the calibration & linearity certificate.



Accepted accuracy:

- **As Left** - Enter maximum allowed deviation
- **As Found** - Enter maximum allowed deviation

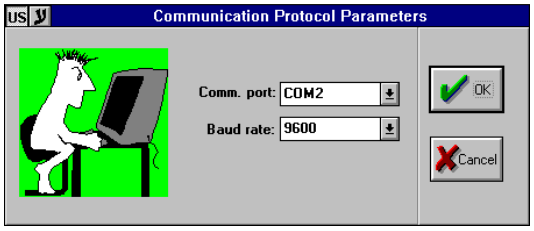
- **Source 1** - Enter source type used in the calibration facility.
- **Source 2** - Enter source type used in the calibration facility.
- **Calibration due** - Set the calibration interval.
- Click **OK** to save data and quit.
- Click **Cancel** to cancel data changes and quit.

Select Parameters / Template from the pull down menu.

In the **Template Settings** window perform the following:
Template name - Fill new template name
Instrument - Select instrument type/ name
Note: For the DRM select TelePole meter.
Units - Select units to be used in this template
New template - Save current template settings into a new file
Open template file - Select existing template without changing it

10.3.1 Set PC Communication Port

Select Parameters / Communication from the pull down menu.
Set the **Comm. port**.
Set Baud rate (19200 BPS).



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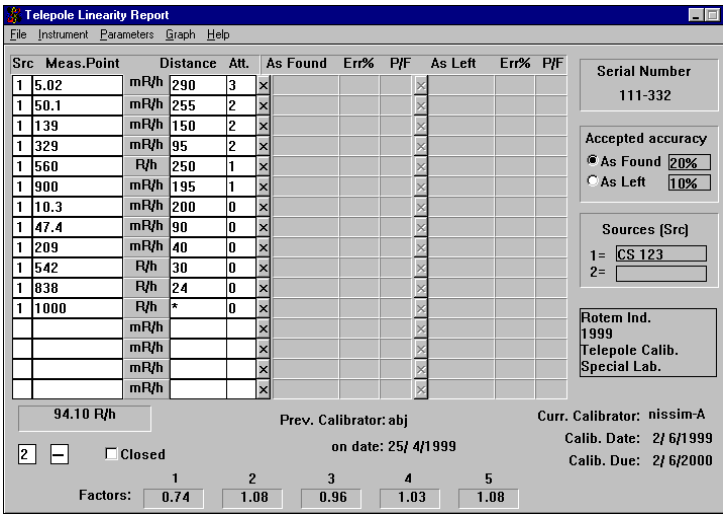
10.4 Starting-up the Calibration & Linearity Process

1) Connect the DRM to the computer via the appropriate **Comm. Port using a NULL Modem adaptor** (according to the selected port in the set up program).
2) Turn the meter on and ensure dipswitches 1 and two are in the ON position
3) Execute the RMC file.
4) Enter **User name** up to 12 characters i.e., jsmith.
5) Enter **Password,** type **mgpi** (in small letters).
6) To check and calibrate the instrument, first enter **Linearity** and check **As Found**. Then enter from the pull down menu to **Instrument/ Calibration.** After calibration is performed, return to **Linearity** and check **As Left**.



Note: If the computer / instrument communication failure or is disconnection, the Communication Error Message is displayed in the computer's display. Check the communication cable, Comm. Port, or dip switch settings on the DRM. Also, check the communications port of the PC.

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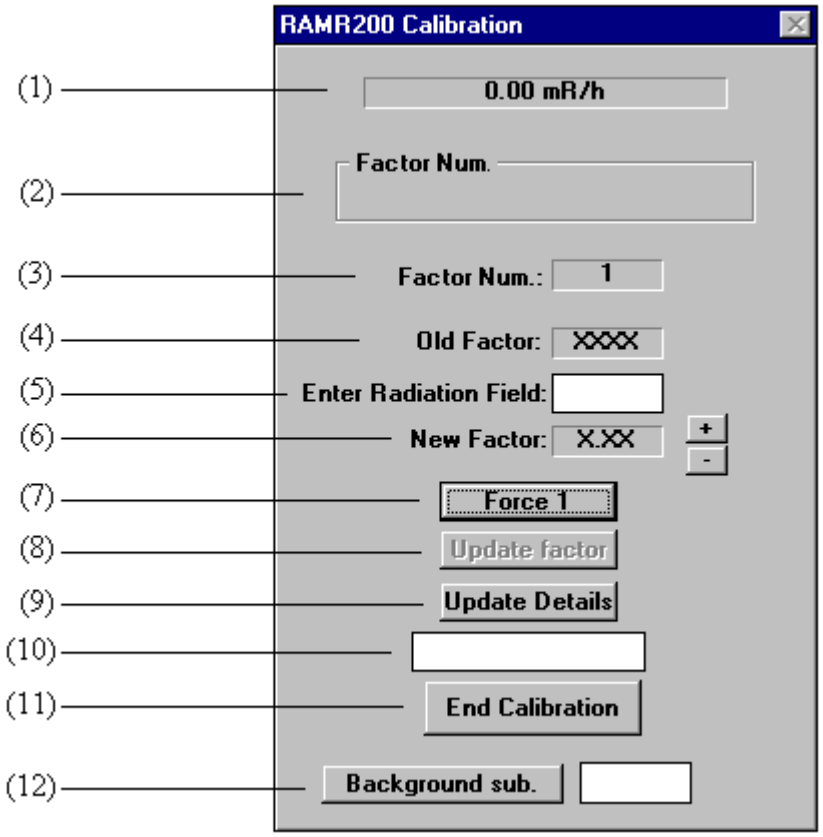
10.5 Calibration

Select **Instrument/Calibrate…** from the pull down menu. The calibration menu will be displayed.



(1) Instrument reading – Current dose rate reading

(2) Factor Num. - Factor number for the calibration. The listing in this screen depends on the amount of calibration points available from the instrument. If the "Auto" radio button is selected the software will recognize the filed value and allow for calibration of the pertinent point. If the calibrator wants to insert a factor into a specific range, he or she simply selects the field.

(3) Factor Num. - Current active factor number. This window will display the current active factor number and is especially useful in the Auto mode for reference purposes.

Note: The calibration factors are selected according to the detector's radiation field location. Only the displayed factor can be changed.

(4) Old Factor: - Previous calibration factor as saved (stored) in the instrument memory.

(5) Enter Radiation Field: - Factor can be changed in two modes:

- **a.** Insert the measured field. The computer will calculate the new factor dependant on the radiation field and the old factor. The new factor value will be displayed on the **New Factor** box**.**
- **b.** Using the ± boxes.

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(6) New Factor: - The New Factor will be displayed and is a function of the actual current reading against the Radiation field that was typed into the window. If the calculated factor value is lower than 0.6 or higher than 1.4, calibration will be not performed.

(7) Force 1 – Select in case the operator wants to force the calibration factor to 1.00. Use this when an incorrect factor was stored.

(8) After the factor changing, press Update Factor. Ensure to obtain the status: Factor Accepted.

(9) Update Details - Press Update Details.

(10) Ensure to obtain Status: Details Accepted.

(11) End Calibration – Click to quit the calibration function and return to the main menu.

(12) Background sub (currently not in use).

10.6 Linearity

To enter the Linearity Report window press File → New Report. The Linearity Report window includes As Found and As Left columns. Before calibration and linearity check, perform the proceeding steps in the following order:

1) Check the linearity in As Found column.
2) If linearity fail is obtained the instrument is defective and cannot be calibrated (P/F –fail).
3) If linearity As Found is ok, calibrate the instrument.
4) Check the linearity in As Left column.
5) In order to check linearity and perform calibration to other instrument, select File →New report on the pull down menu.

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10.6.1 Linearity Report Window Description

Src – Type of source employed for calibration and linearity. The source type is defined in the set-up parameters.

Meas.Point - Radiation field where linearity tests are performed.

Unit - Measurement units.

Distance and **Att. -** Distance between detector and source and attenuator factor.

As Found - Instrument reading prior to calibration.

As Left - Instrument reading after calibration.

Err% - Reading deviation % between measuring point (calculated value) and meter reading.

P/F - Notifies that linearity checking is correct.

Serial Number - Instrument number, may be changed in **Parameters / Instrument**.
Accepted accuracy - Permitted deviation in % between the instrument reading and radiation. Defined in the **Parameters / Set up**.

Sources [Src] - Source type by which calibration and linearity were performed. Defined in the set-up parameters.

Customer Header- Customer: Enter header (up to 4 lines) for the calibration & linearity certificate.

Curr. Calibrator - Present calibrator's name and calibration date.

Prev. Calibrator - Former calibrator's name and calibration date.

Factors - Factors' value.
(1) Checking adequate connection between instrument and computer. If after the fifth time there is no communication, an alarm message is displayed.
(2) 0.00 mR/h - Instrument reading is updated every second.
(3) Closed - After checking the first reading by pressing **X** on the tested point line, it is recommended to perform **File → Save as**. From now on, the file is automatically updated and saved after checking of each tested point. As long as the **Closed** text box is not marked, it is possible to make changes while entering and exiting the file. At the end of the linearity check process, marking ✓in the **Closed** text box will make the file "read only". From now on, when entering the saved file marked ✓ **Closed**, it will be impossible to perform any changes in the **Linearity Report** window.

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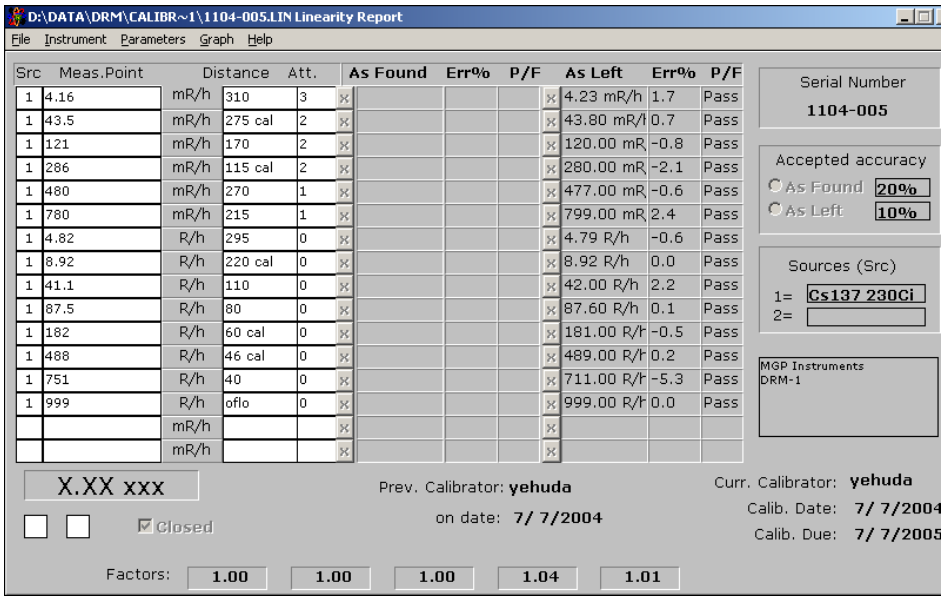
D:\DATA\DRM\CALIBR~1\1104-005.LIN Linearity Report
File Instrument Parameters Graph Help
Src Meas.Point Distance Att. As Found Err% P/F As Left Err% P/F
1 4.16 mR/h 310 3 4.23 mR/h 1.7 Pass
1 43.5 mR/h 275 cal 2 43.80 mR/h 0.7 Pass
1 121 mR/h 170 2 120.00 mR -0.8 Pass
1 286 mR/h 115 cal 2 280.00 mR -2.1 Pass
1 480 mR/h 270 1 477.00 mR -0.6 Pass
1 780 mR/h 215 1 799.00 mR 2.4 Pass
1 4.82 R/h 295 0 4.79 R/h -0.6 Pass
1 8.92 R/h 220 cal 0 8.92 R/h 0.0 Pass
1 41.1 R/h 110 0 42.00 R/h 2.2 Pass
1 87.5 R/h 80 0 87.60 R/h 0.1 Pass
1 182 R/h 60 cal 0 181.00 R/h -0.5 Pass
1 488 R/h 46 cal 0 489.00 R/h 0.2 Pass
1 751 R/h 40 0 711.00 R/h -5.3 Pass
1 999 R/h oflo 0 999.00 R/h 0.0 Pass
mR/h
mR/h
Serial Number
1104-005
Accepted accuracy
As Found 20%
As Left 10%
Sources (Src)
1= Cs137 230Ci
2=
MGP Instruments
DRM-1
X.XX xxx
Closed
Prev. Calibrator: yehuda
on date: 7/ 7/2004
Curr. Calibrator: yehuda
Calib. Date: 7/ 7/2004
Calib. Due: 7/ 7/2005
Factors: 1.00 1.00 1.00 1.04 1.01

10.7 Save, Load and Print Calibration and Linearity Certificate

10.7.1 Save and Print Current Calibration and Linearity Certificate

1) Click **File / Save** for saving the Calibration and Linearity Certificate in a file.
2) Click **File / Print** for Calibration and Linearity Certificate printout.
3) Click **Graph** to display Linearity graph.
4) Click **Plot** and select **Linearity** or **Relative Error** graph.
5) Click **File / Print** for Linearity graph printout.

10.7.2 Load and Print Previous Calibration and Linearity Certificate

1) To load a previous Calibration and Linearity Certificate click File/ Open.
2) Double click to select the appropriate drive.
3) Double click to select the appropriate file.
4) Click File / Print for Calibration and Linearity Certificate printout.
5) Click Graph to display Linearity graph.
6) Click Plot and select Linearity or Relative Error graph.
7) Click File / Print for Linearity graph printout.

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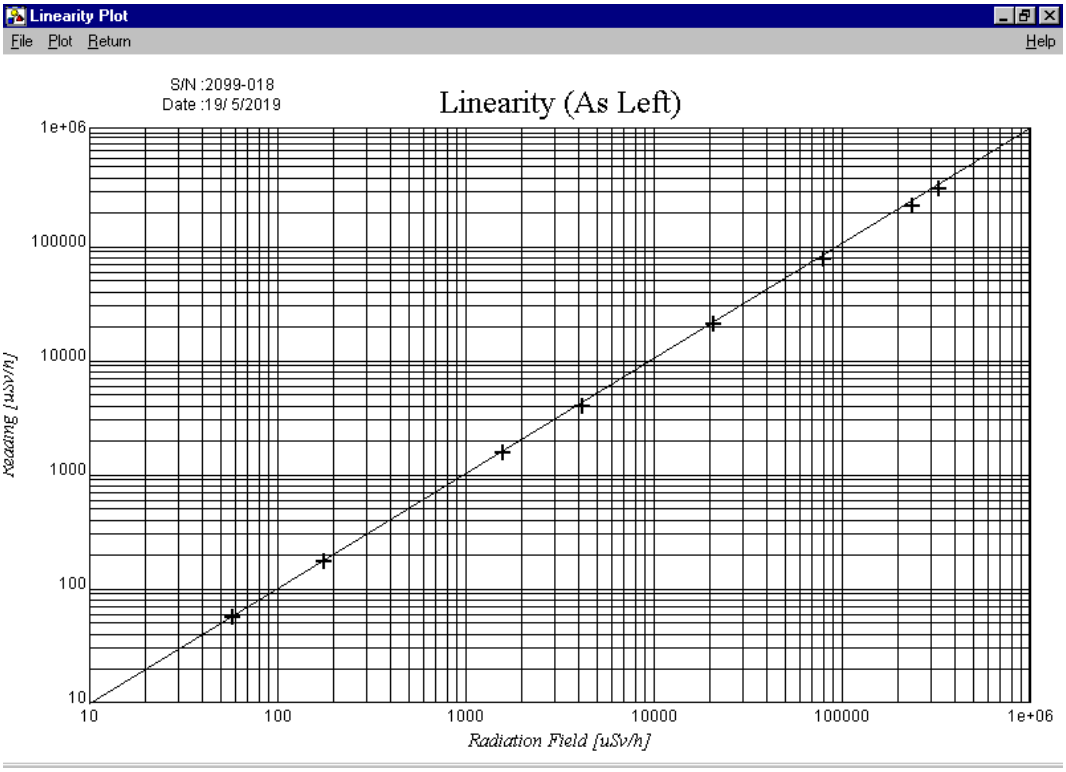

10.8 DRM-1/2 CPS to mR/h Conversion Table

Table 1 - Low Range GM tube

Input Frequency [Hz]	Display [mR/h]
17	1.00
170	10.0
2000	141
4000	365
5000	534
6000	730
6300	804*

Table 2 - High Range GM tube

Input Frequency [Hz]	Display [R/h]
300	1.00
3200	10.7
10.000	39.2
30.000	183
40.000	323
50.000	525
60.000	839
75.000	O.F. (overflow)

- Switches to high range detector

Note: These results are valid only when all factors equal to 1.

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10.9 DRM-1D/2D CPS to mR/h Conversion Table

Input Frequency [KHz]	Display [mR/h]
1	0.147
2.8	0.397
4.9	0.795
8.75	1.590
11.9	2.385
14.6	3.180
16.9	3.975
19.1	4.770
21.1	5.565
22.7	6.360
24.4	7.155
25.8	7.950
28.5	9.540
30	OFLO

These results are valid only when **F1** is equal to 1

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11. Upgrading the DRM firmware

Note: Follow these directions carefully (contact MGPI for assistance)

1. Install the DRM Firmware Updater software by unzipping the files to a known directory and clicking on the 'Setup' in the 'Installer' directory.
2. Disconnect the meter from the power supply and ensure that the **battery back-up is also turned OFF**; dip switches 1 and 2 in the OFF position, see figure 2 or 3
3. Set dipswitch 1& 2 to on position
4. Set dipswitch 3 to 8 to off position
5. Open the back meter panel, see figure 2 or 3
6. Switch E1 located at mother board card to update position (upward). See Figure2 for the DRM-1 or Figure 3 DRM-1D
7. Connect the meter to the PC via the RS-232 cable and NULL modem adapter.
8. To start the Firmware Updater software double clicking the 'Application.exe' icon in the known directory.(see next page for screen view)

9. Set the PC Communications Port and load the supplied *.hex file,, i.e. "drm1-4769.hex" located in the known created directory for the software.
10. Select "send an answer " function 1 (Check)
11. Click on the Start (white arrow) to initialize the program.
12. Connect the meter to the power supply information should appear in the File Read screen.
13. If the menu does not appear, turn (disconnect) the power supply off, click on the stop (red point) icon and go back to item 10
14. Click on the "send 1" button
15. Check that the right hand window displays "Enter to command > 1 ****** Ready to receive**
16. Click on "send 2"
17. Check that the right hand window **displays "The file was verified and is good for update"** Enter command
18. Select "send an answer " function 2 (Update)
19. Click on "send 1"
20. Check that the right hand window displays "Enter to command > 2 ****** Ready to Receive**
21. Click on "send 2" wait…
22. Check that the right hand window displays **"Firmware update complete"** and verify that the information in the window is exactly like figure 1 before removing the AC power
23. Disconnect the power supply and remove the serial/null cable.
24. Switch E1 located on the motherboard card 2143 to inverse "update" position (downward).
25. Connect the power supply and verify that the meter operates.
26. Ensure Dip Switches 1, 2, and 3 are in the ON position.

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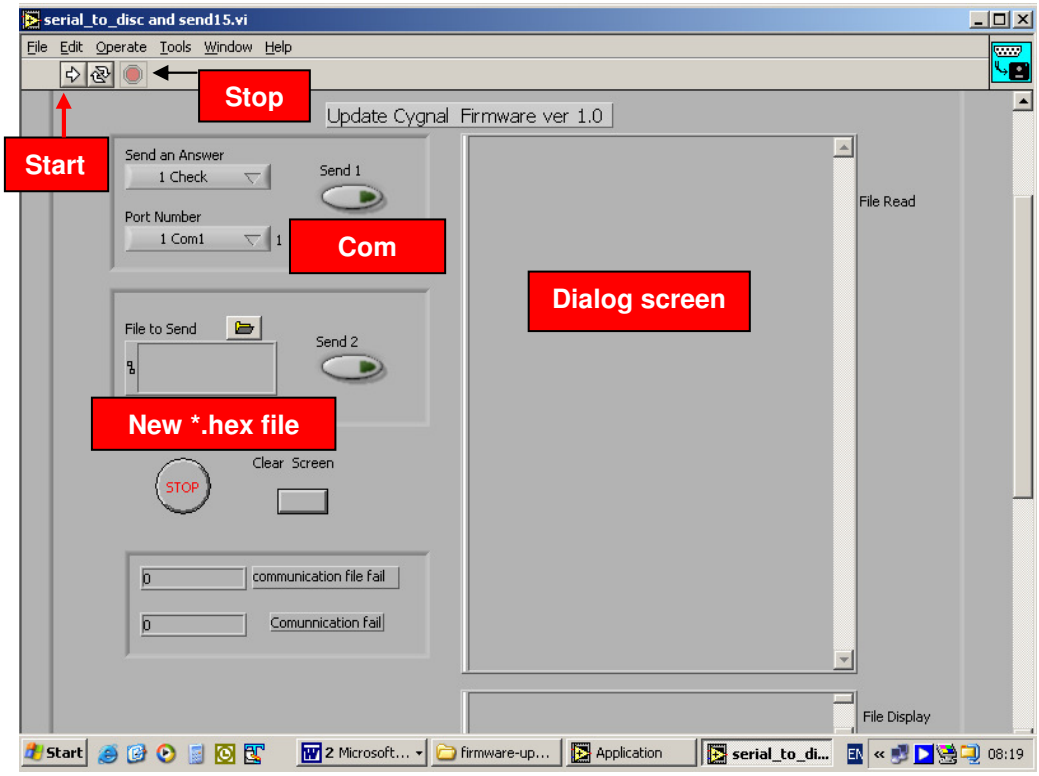
Firmware Update Screen



Firmware "Updated" Screen

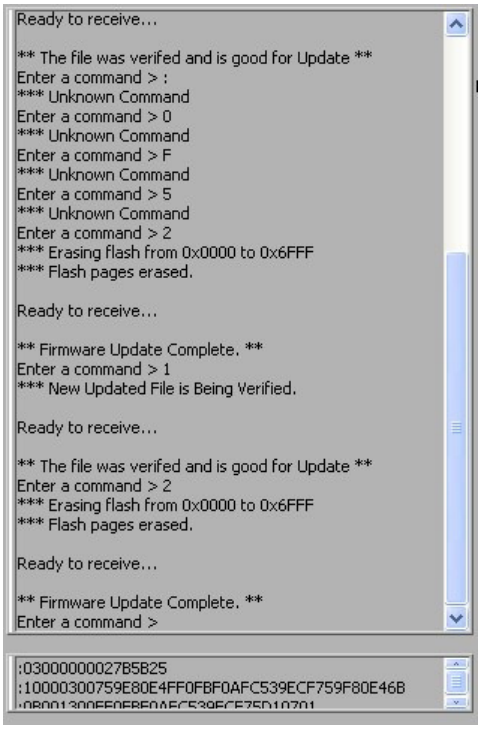
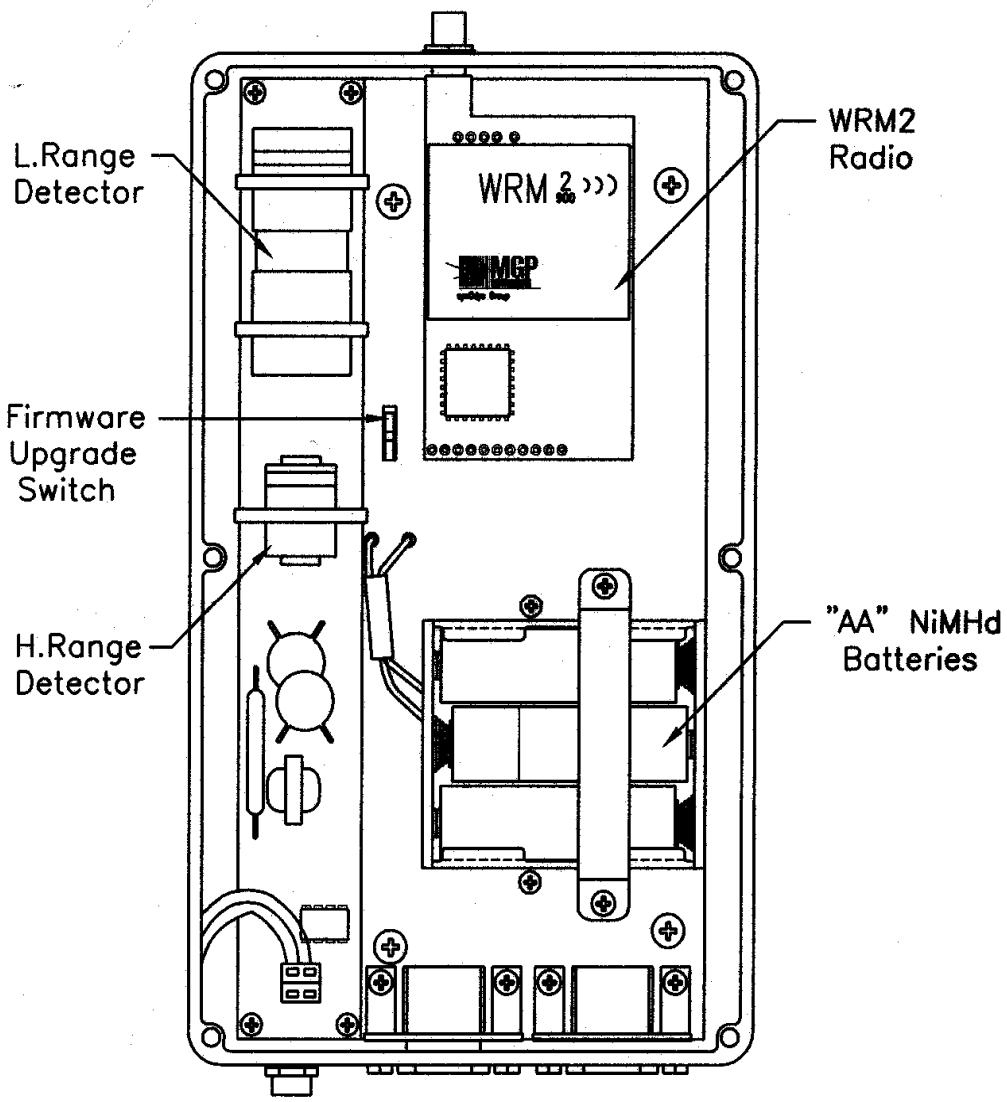
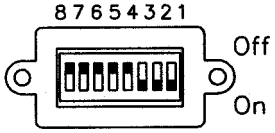

Ready to receive...
** The file was verifed and is good for Update **
Enter a command > :
*** Unknown Command
Enter a command > 0
*** Unknown Command
Enter a command > F
*** Unknown Command
Enter a command > 5
*** Unknown Command
Enter a command > 2
*** Erasing flash from 0x0000 to 0x6FFF
*** Flash pages erased.
Ready to receive...
** Firmware Update Complete. **
Enter a command > 1
*** New Updated File is Being Verified.
Ready to receive...
** The file was verifed and is good for Update **
Enter a command > 2
*** Erasing flash from 0x0000 to 0x6FFF
*** Flash pages erased.
Ready to receive...
** Firmware Update Complete. **
Enter a command >
:03000000027B5B25
:10000300759E80E4FF0FBF0AFC539ECF759F80E46B

Figure 2. DRM-1



INSIDE VIEW

Set communication &
Battery Switch



Dip Switch On Position

1&2 Meter to PC
3&4 Meter to Internal Transmitter
5&6 Internal Transmitter to PC
7&8 Battery Switch

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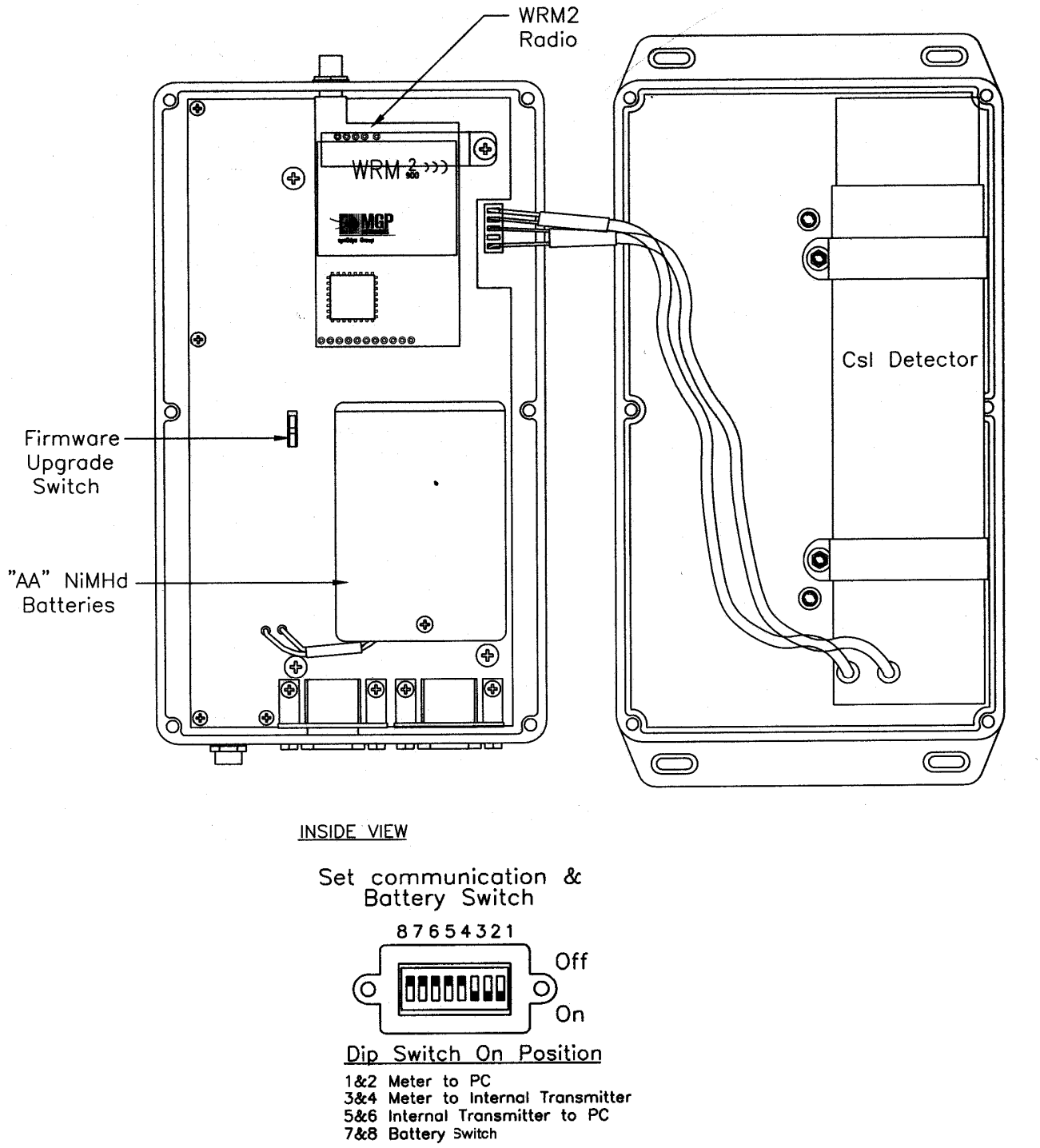
Figure 3. DRM-1D



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12. DRM - List of Electronic Schematics

Note: The following schematics are for information only and are not subject to revision control.

DRW #12850-40-00 CPU - PC #2142
DRW #12850-40-00 Mother Board PC #2143
DRW #12852-40-00 DRM WR, GM Detector, PC #2003
DRW #12852-40-00 DRM WR, PMT HV PC #2173
DRW #12852-40-00 DRM WR, ALARM & DISPLAY PC #2175

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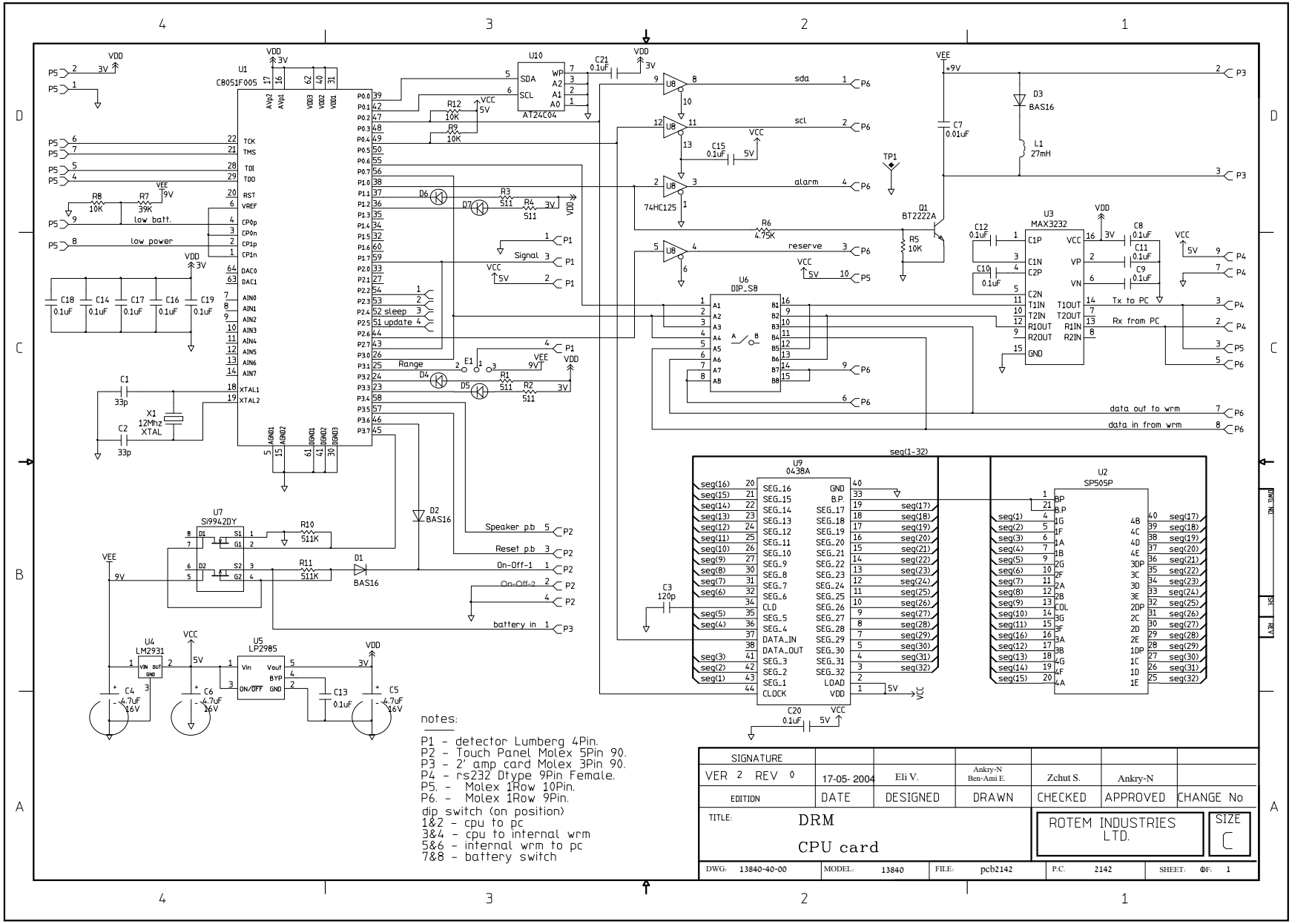
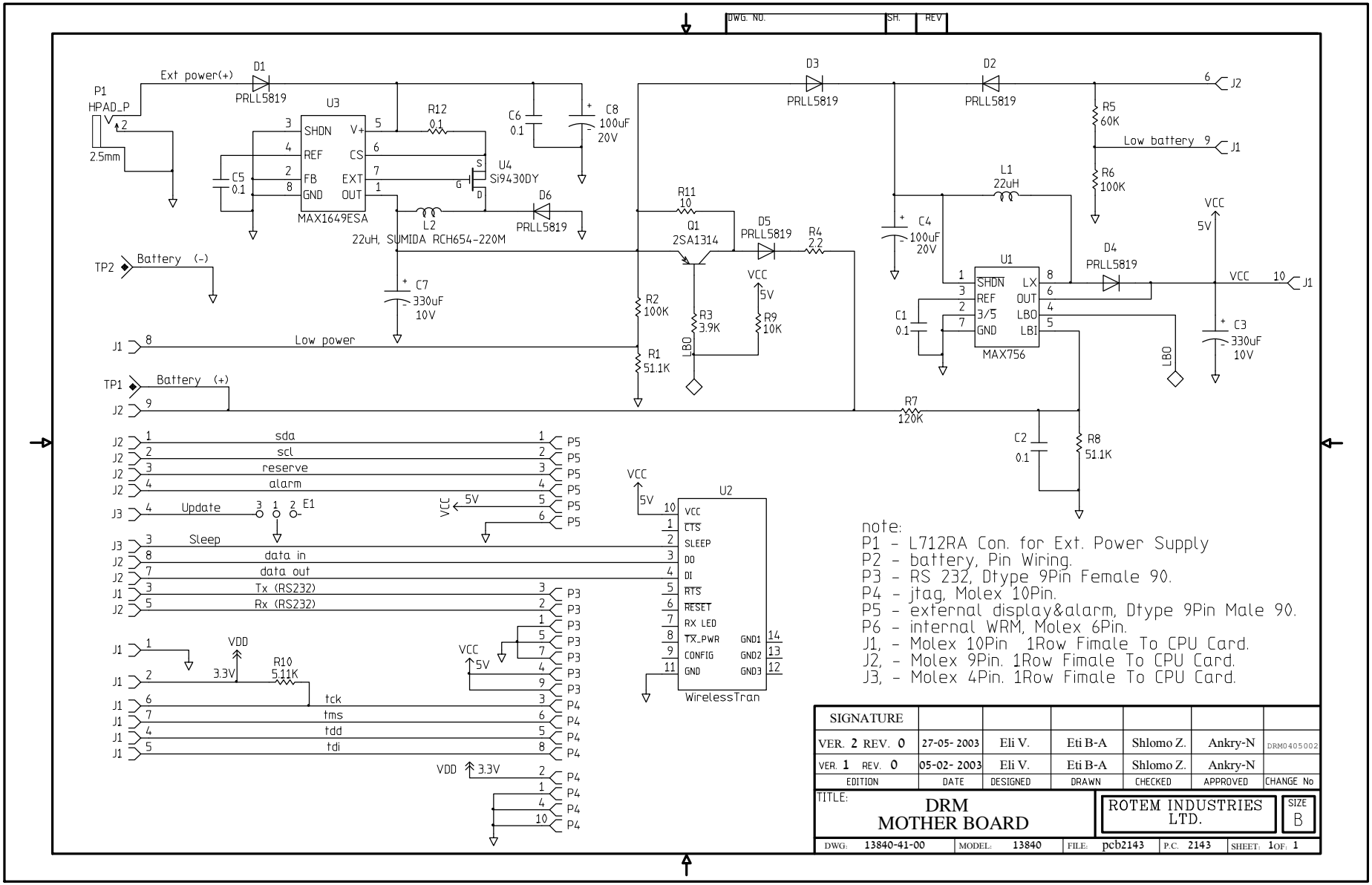

U1
C8051F005
U10
AT24C04
U8
74HC125
U6
DIP_S8
U3
MAX3232
U9
0438A
U2
SP505P
U7
Si9942DY
U4
LM2931
U5
LP2985
Q1
BT2222A
TP1
D1
BAS16
D2
BAS16
D3
BAS16
D4
D5
D6
D7
E1
X1
12Mhz
XTAL
sda
scl
alarm
reserve
Signal
Range
sleep
update
low batt.
low power
Speaker p.b
Reset p.b
On-Off-1
On-Off-2
battery in
Tx to PC
Rx from PC
data out to wrm
data in from wrm
seg(1-32)
notes:
P1 - detector Lumberg 4Pin.
P2 - Touch Panel Molex 5Pin 90.
P3 - 2' amp card Molex 3Pin 90.
P4 - rs232 Dtype 9Pin Female.
P5. - Molex 1Row 10Pin.
P6. - Molex 1Row 9Pin.
dip switch (on position)
1&2 - cpu to pc
3&4 - cpu to internal wrm
5&6 - internal wrm to pc
7&8 - battery switch
SIGNATURE
VER 2 REV 0
17-05- 2004
Eli V.
Ankry-N
Ben-Ami E.
Zchut S.
Ankry-N
EDITION
DATE
DESIGNED
DRAWN
CHECKED
APPROVED
CHANGE No
TITLE:
DRM
CPU card
ROTEM INDUSTRIES LTD.
SIZE
C
DWG: 13840-40-00
MODEL: 13840
FILE: pcb2142
P.C. 2142
SHEET: 1 OF: 1



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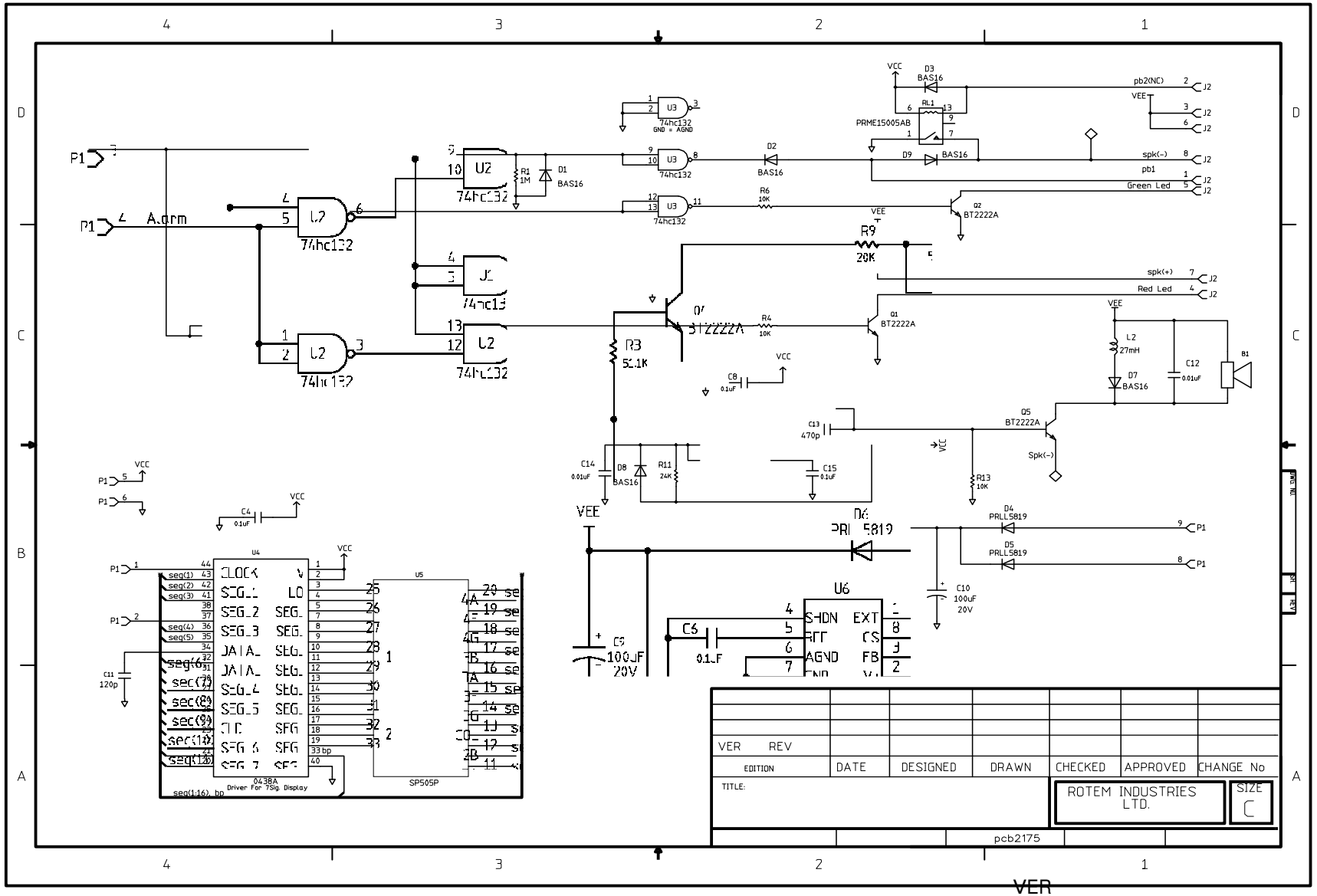
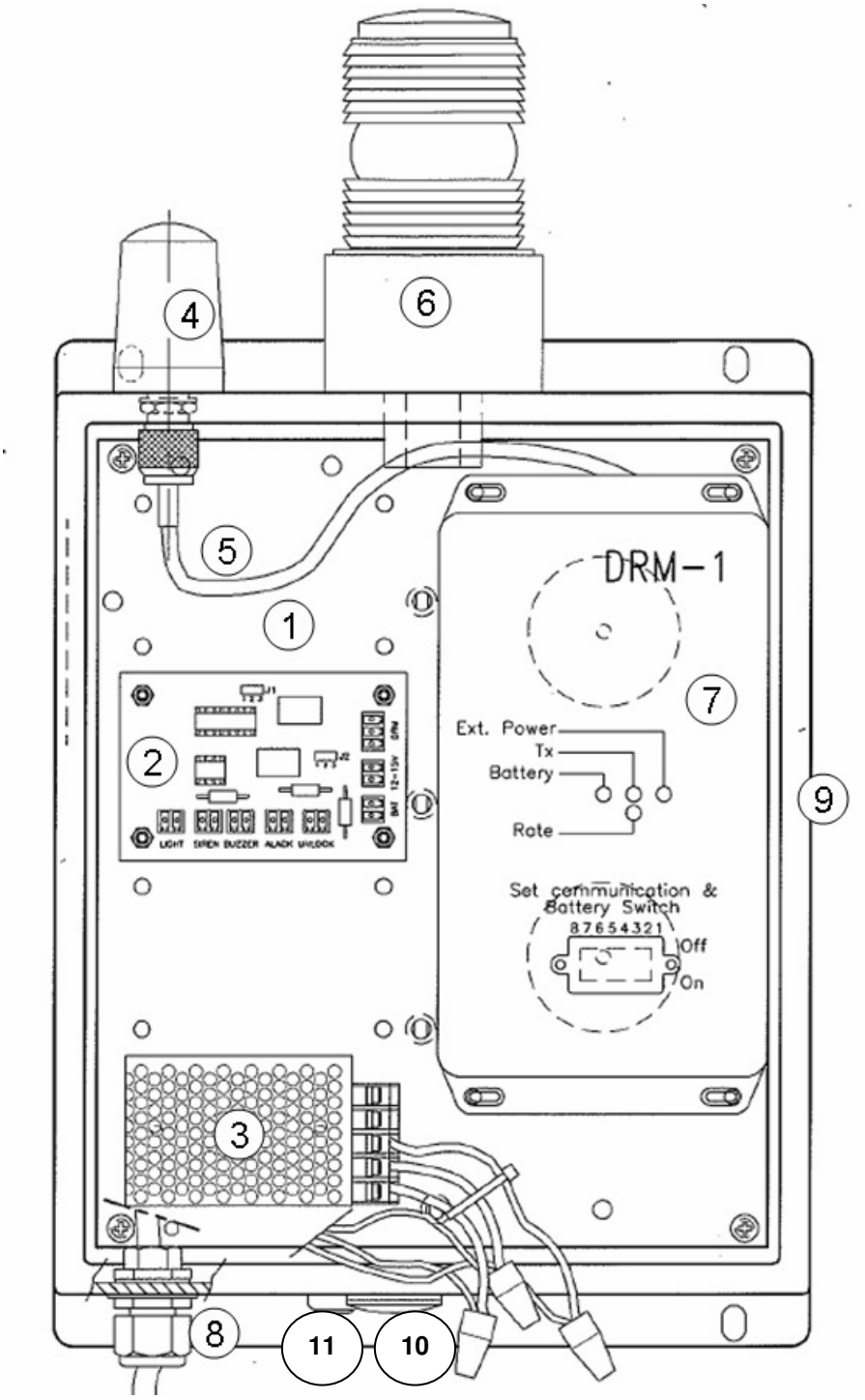

A.drm
74hc132
BAS16
BT2222A
PRME15005AB
PRL5819
SP505P
0438A
Driver For 7Sig. Display
pb2(NC)
spk(-)
pb1
Green Led
spk(+)
Red Led
Spk(-)
VCC
VEE
VER
REV
EDITION
DATE
DESIGNED
DRAWN
CHECKED
APPROVED
CHANGE No
TITLE:
ROTEM INDUSTRIES LTD.
SIZE
pcb2175

13. DRM - Environmental Enclosure Configuration

Environmental Enclosure Assembly: Figure 13-1



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Environmental Enclosure Assembly (Figure 14-1)

1 Mounting Plate
2 Circuit Board
3 Power Supply
4 Telemetry Antenna
5 Antenna Cable
6 Strobe Light
7 DRM-1/D Monitor
8 Power Cable
9 Environmental Enclosure
10 Audible Buzzer
11 Acknowledge Pushbutton

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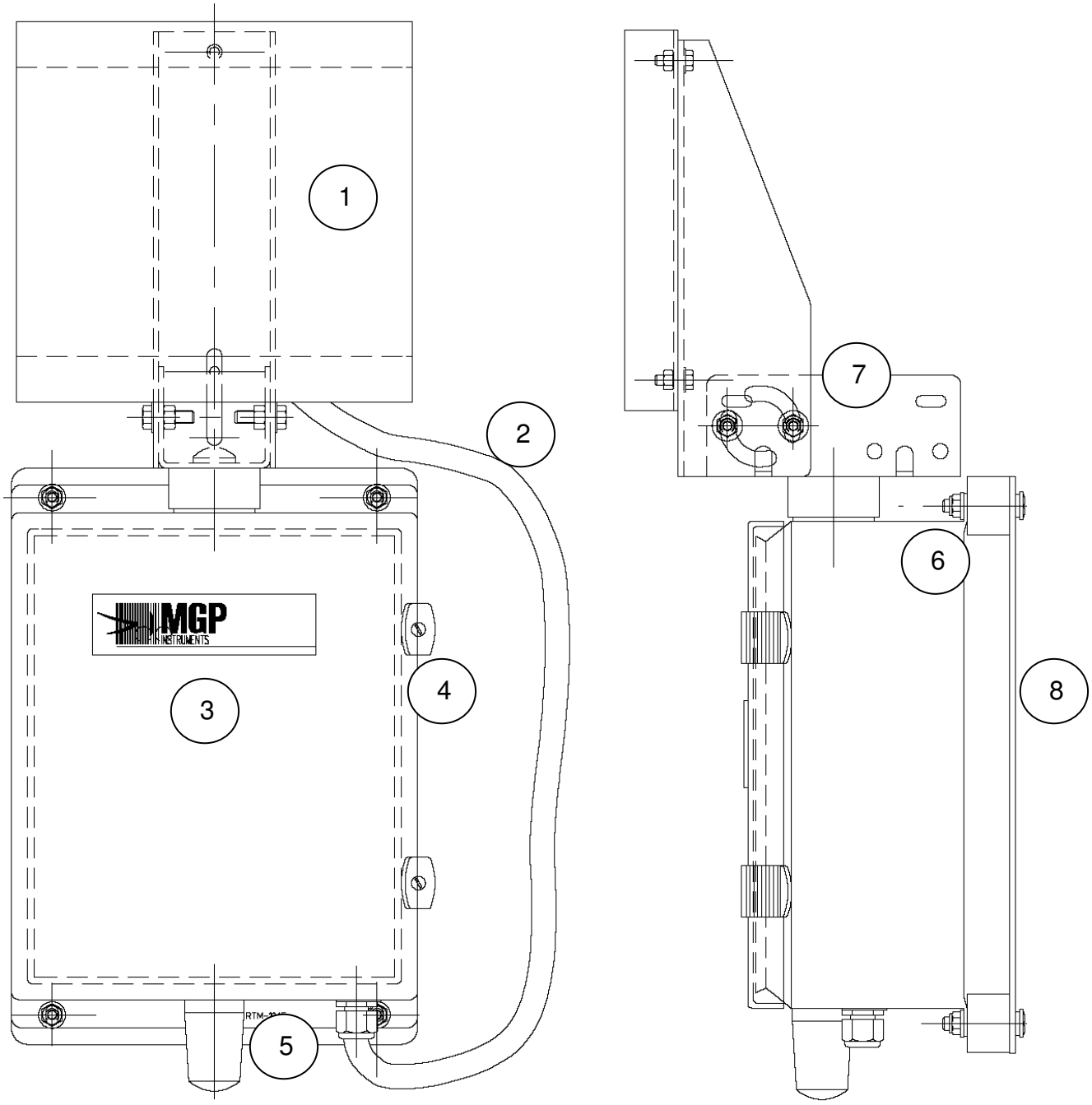
14. DRM Solar Configuration

Solar Panel and Enclosure Assembly: Figure 14-1



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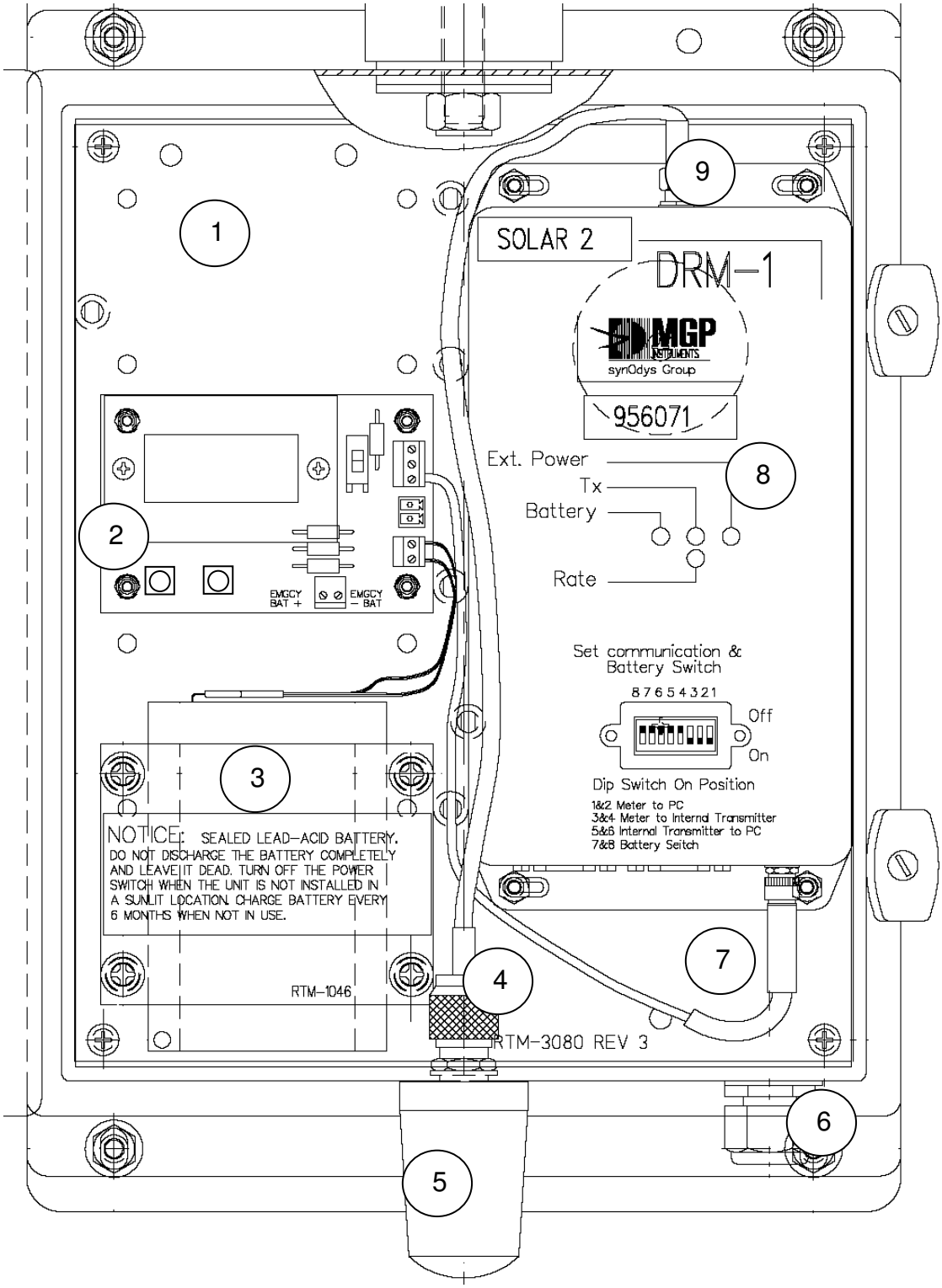
Internal Enclosure Assembly: Figure 14-2



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Solar Panel & Enclosure Assembly (Figure 14-1)

1 Solar Panel element
2 Power Cable (Solar Panel)
3 Environmental Enclosure
4 Door Locking Mechanism
5 Telemetry Antenna
6 Bushings (4)
7 Mounting bracket for Solar Panel element
8 Mounting plate

Internal Enclosure Assembly (Figure 14-2)

1 Mounting plate
2 Interface Board
3 Sealed Lead Acid Battery
4 RPSMA to N-Type Antenna Cable
5 Telemetry Antenna
6 Power Cable Connector
7 DRM-1 Power Connector
8 DRM-1 Detector
9 RPSMA Antenna Connector

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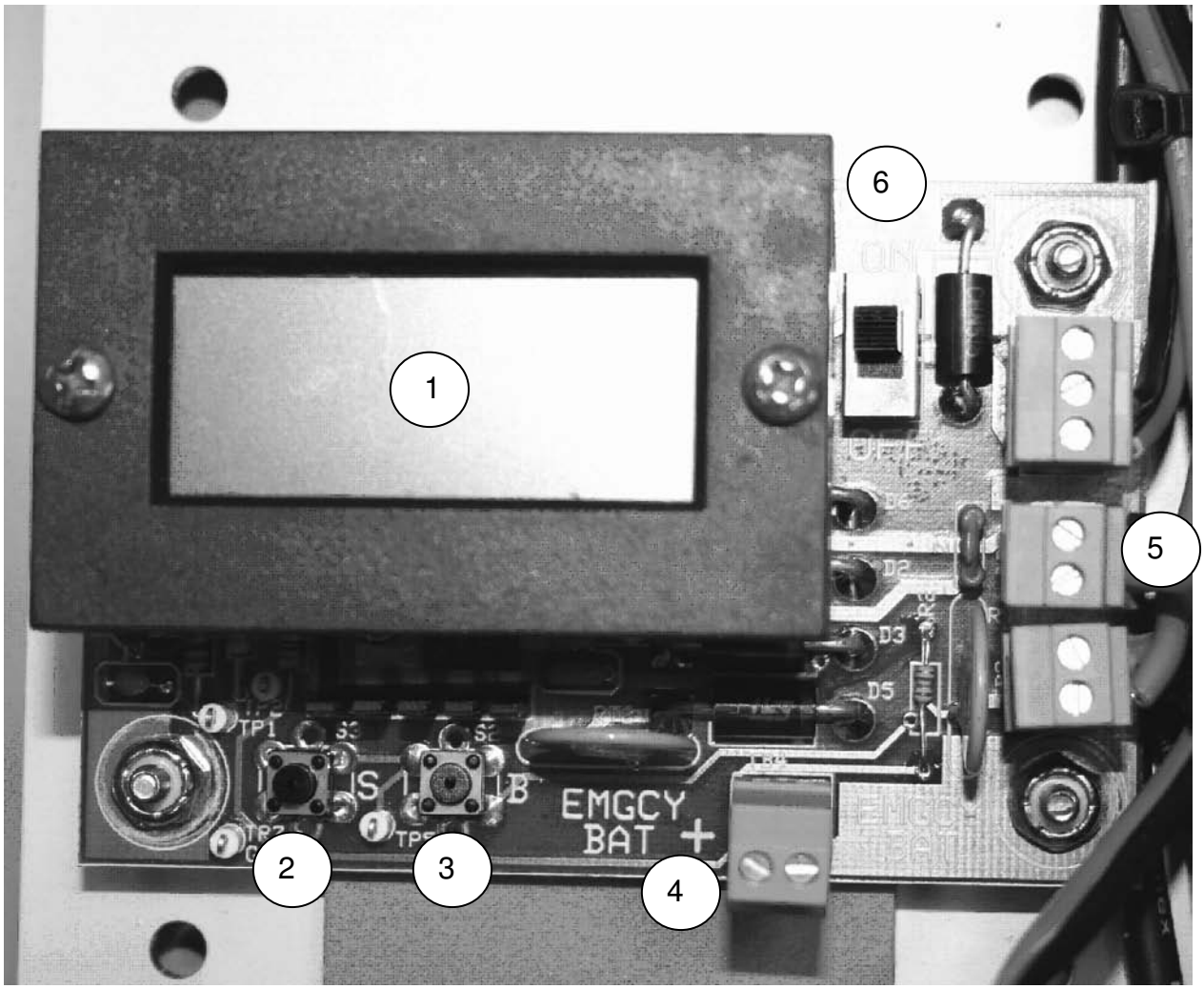
Interface Board: Figure 14-3



Interface Board (Figure 14-3)

1 LCD Display
2 Pushbutton – display Solar Power draw (voltage)
3 Pushbutton – display Battery Voltage
4 Emergency Battery (power) connector
5 Power – Charging - Connector
6 Main On-Off Power Switch

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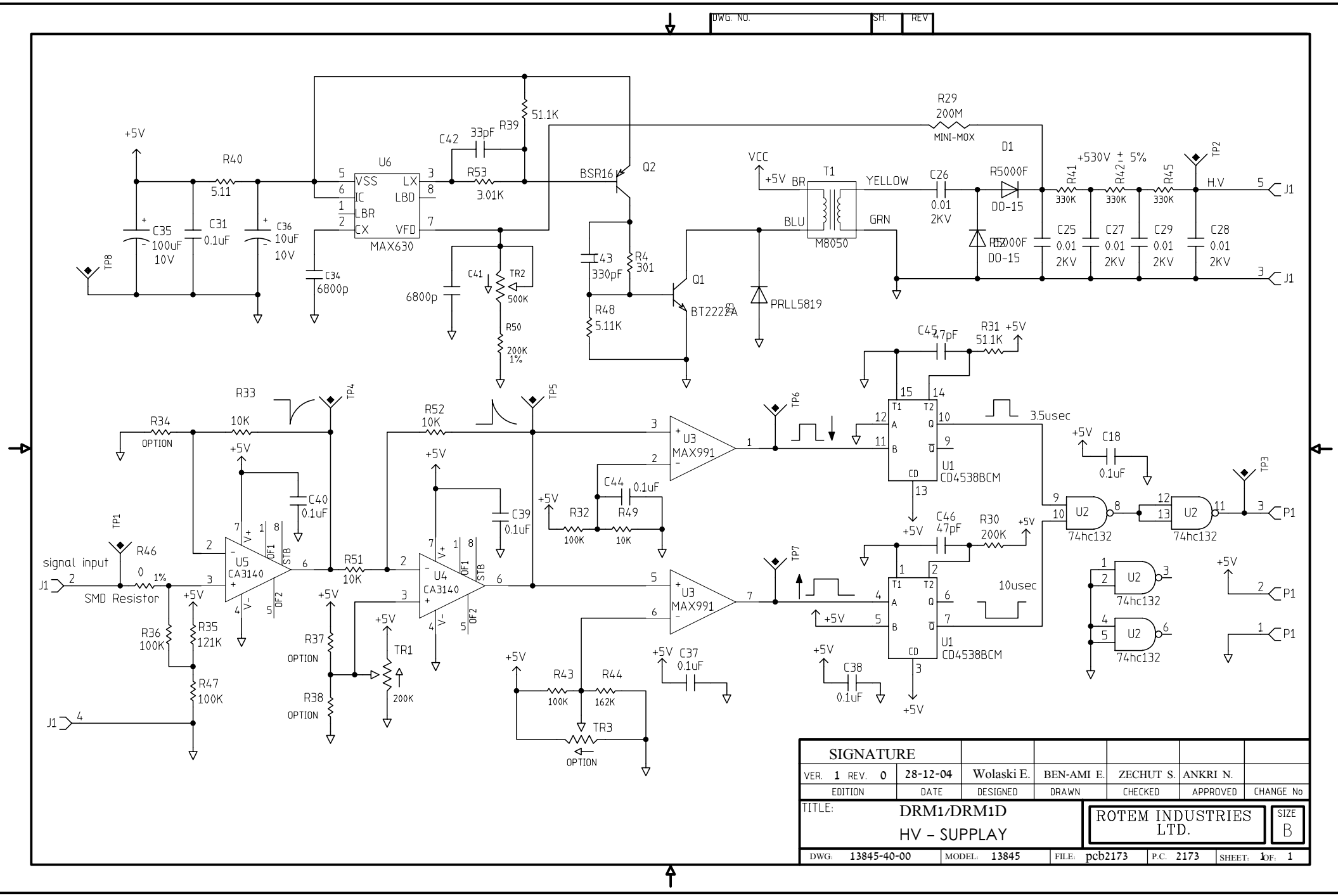
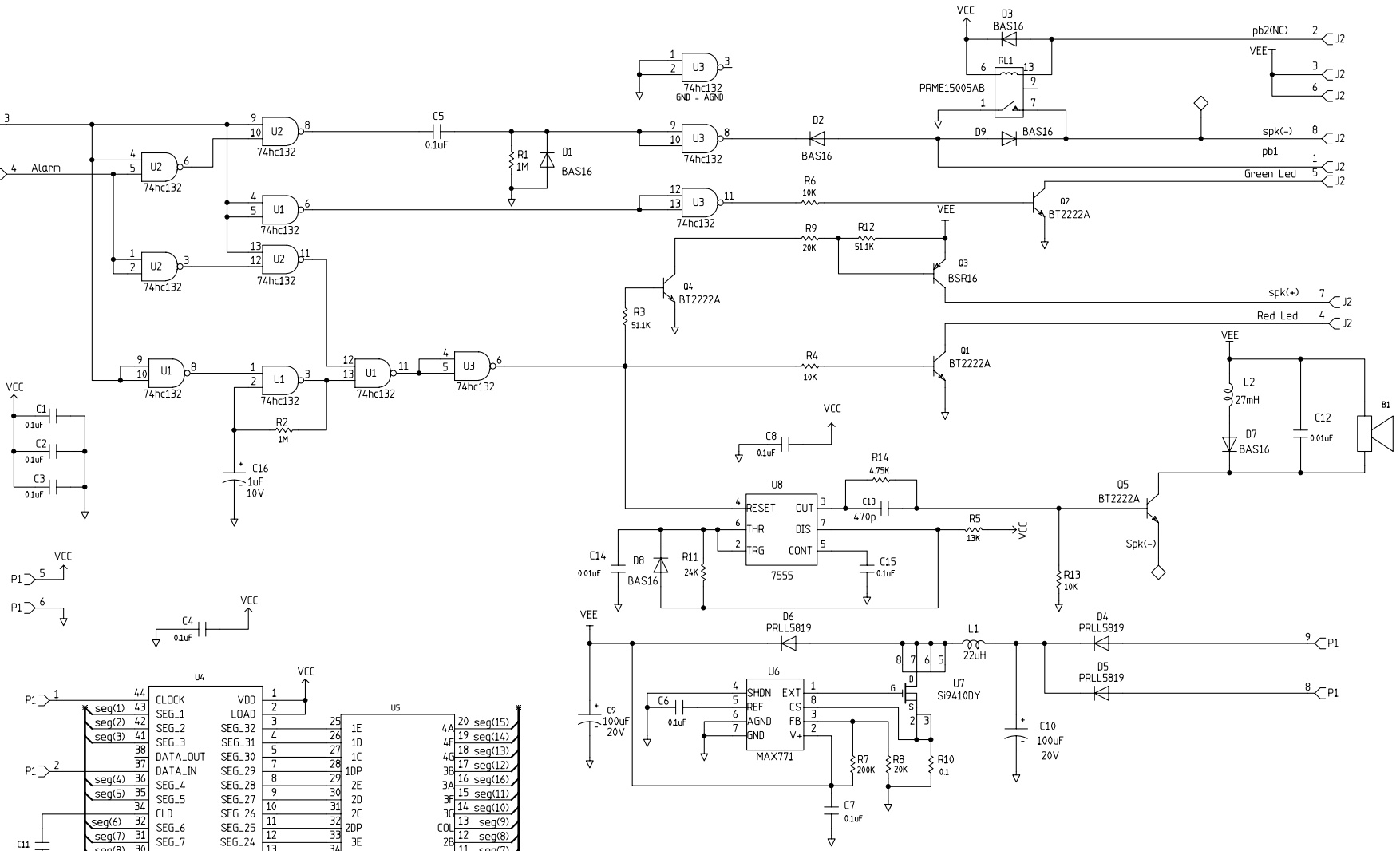

DWG. NO.
SH.
REV
+5V
R40
5.11
C35
100uF
10V
C31
0.1uF
C36
10uF
10V
TP8
U6
MAX630
VSS
IC
LBR
CX
LX
LBD
VFD
C34
6800p
C42
33pF
R39
51.1K
R53
3.01K
BSR16
Q2
C41
6800p
TR2
500K
R50
200K
1%
C43
330pF
R4
301
R48
5.11K
Q1
BT2222A
PRLL5819
R29
200M
MINI-MOX
VCC
T1
M8050
BR
BLU
YELLOW
GRN
C26
0.01
2KV
D1
R5000F
DO-15
R5000F
DO-15
+530V + 5%
R41
330K
R42
330K
R45
330K
TP2
H.V
C25
0.01
2KV
C27
0.01
2KV
C29
0.01
2KV
C28
0.01
2KV
J1
J1
R33
TP4
R34
10K
OPTION
R52
10K
TP5
TP6
C45
47pF
R31
51.1K
U3
MAX991
U1
CD4538BCM
3.5usec
C18
0.1uF
TP3
P1
U2
74hc132
C40
0.1uF
C39
0.1uF
C44
0.1uF
R32
100K
R49
10K
TP1
signal input
J1
R46
0
1%
SMD Resistor
U5
CA3140
U4
CA3140
R51
10K
R36
100K
R35
121K
R47
100K
R37
OPTION
R38
OPTION
TR1
200K
R43
100K
R44
162K
TR3
OPTION
C37
0.1uF
TP7
C46
47pF
R30
200K
10usec
C38
0.1uF
SIGNATURE
VER. 1 REV. 0
28-12-04
Wolaski E.
BEN-AMI E.
ZECHUT S.
ANKRI N.
EDITION
DATE
DESIGNED
DRAWN
CHECKED
APPROVED
CHANGE No
TITLE:
DRM1/DRM1D
HV - SUPPLAY
ROTEM INDUSTRIES LTD.
SIZE
B
DWG: 13845-40-00
MODEL: 13845
FILE: pcb2173
P.C. 2173
SHEET: 1 OF: 1



SIGNATURE						
VER 3 REV 0	19-07-05	Wolaski E.	BEN-AMI E.	ZECHUT S.	ANKRI N.	DRM0507003
VER 2 REV 0	08-02-05	Wolaski E.	BEN-AMI E.	ZECHUT S.	ANKRI N.	DRM0502001
VER 1 REV 0	04-01-05	Wolaski E.	BEN-AMI E.	ZECHUT S.	ANKRI N.	
EDITION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED	CHANGE No

TITLE: DRM1/DRM1D
Alarm Display

ROTEM INDUSTRIES LTD.

SIZE C

DWG: 13845-40-00	MODEL: 13845	FILE: pcb2175	P.C. 2175	SHEET: 1 OF: 1